UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
PREVENTION, PESTICIDES
AND TOXIC SUBSTANCES

Note to Reader
January 15, 1998

Background: As part of its effort to involve the public in the implementation of the Food Quality Protection Act of 1996 (FQPA), which is designed to ensure that the United States continues to have the safest and most abundant food supply. EPA is undertaking an effort to open public dockets on the organophosphate pesticides. These dockets will make available to all interested parties documents that were developed as part of the U.S. Environmental Protection Agency's process for making reregistration eligibility decisions and tolerance reassessments consistent with FQPA. The dockets include preliminary health assessments and, where available, ecological risk assessments conducted by EPA, rebuttals or corrections to the risk assessments submitted by chemical registrants, and the Agency's response to the registrants' submissions.

The analyses contained in this docket are preliminary in nature and represent the information available to EPA at the time they were prepared. Additional information may have been submitted to EPA which has not yet been incorporated into these analyses, and registrants or others may be developing relevant information. It's common and appropriate that new information and analyses will be used to revise and refine the evaluations contained in these dockets to make them more comprehensive and realistic. The Agency cautions against premature conclusions based on these preliminary assessments and against any use of information contained in these documents out of their full context. Throughout this process, If unacceptable risks are identified, EPA will act to reduce or eliminate the risks.

There is a 60 day comment period in which the public and all interested parties are invited to submit comments on the information in this docket. Comments should directly relate to this organophosphate and to the information and issues available in the information docket. Once the comment period closes, EPA will review all comments and revise the risk assessments, as necessary.

These preliminary risk assessments represent an early stage in the process by which EPA is evaluating the regulatory requirements applicable to existing pesticides. Through this opportunity for notice and comment, the Agency hopes to advance the openness and scientific soundness underpinning its decisions. This process is designed to assure that America continues to enjoy the safest and most abundant food supply. Through implementation of EPA's tolerance reassessment program under the Food Quality Protection Act, the food supply will become even safer. Leading health experts recommend that all people eat a wide variety of foods, including at least five servings of fruits and vegetables a day.

Note: This sheet is provided to help the reader understand how refined and developed the pesticide file is as of the date prepared, what if any changes have occurred recently, and what new information, if any, is expected to be included in the analysis before decisions are made. **It is not meant to be a summary of all current information regarding the chemical.** Rather, the sheet provides some context to better understand the substantive material in the docket (RED chapters, registrant rebuttals, Agency responses to rebuttals, etc.) for this pesticide.

Further, in some cases, differences may be noted between the RED chapters and the Agency's comprehensive reports on the hazard identification information and safety factors for all organophosphates. In these cases, information in the comprehensive reports is the most current and will, barring the submission of more data that the Agency finds useful, be used in the risk assessments.

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Methidathion-Environmental Fate and Effects RED Chapter

December 29, 1998

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I. Methidathion Use Overview

Methidathion is a non-systemic organophosphate insecticide/acaricide registered for use to control a wide range of sucking, leaf-eating, and scale insects on terrestrial food crops: artichokes, cotton, and orchard crops, (pome, stone, citrus), and also nuts, grapes, olives, safflower, and pistachios. Methidathion also has a terrestrial non-food use (nursery stock). Methidathion acts by inhibiting certain enzymes in the invertebrate system. The only currently supported single active ingredient formulation of methidathion is a 25% wettable powder. (The E.C. was phased out of use during 1996). Approximately 90-95% of methidathion use is in California. The crops with the greatest number of acres treated with methidathion are cotton (120,000 acres), tree nuts (65,000 acres), and stone fruit (60,000 acres). A total of 459,000 lb ai are used annual. Methidathion is registered as an RUP, restricted for use by certified applicators only.

Table : Methidathion National Usage Summary

Crop	Major pest controlled	% crop treated nationally	# acres treated (000)	max ai/A per app.	max # apps	typical ai/A per app.	typical # apps
Almonds	scales, peach twig borer	3	(65--for all tree nuts)	3	1	1.5	1
Artichokes	plume moth	20	8	1	8	1	2
Citrus	scales	1	49	5	2	2	1
Cotton	lygus	0.2	120	1	16	0.5	2
Olives	scales	19	11	3	1	1.5	1
Pome fruits	scales, aphids	0.9	44	3	1	1.5	1
Stone fruits	scales, peach twig borer	3	60	3	1	1.5	1
Safflower	lygus	17	40	0.5	3	0.5	1
Walnuts	scales, codling moth, navel orange worm	3	(65--for all tree nuts)	3	3	1.5	1

II. Environmental Fate and Chemistry of Methidathion

A. Chemical Profile:

<u>Common name</u>: Methidathion.

<u>Chemical name</u>: 3-Dimethoxyphosphinothioylthiomethyl-5-methoxy-1,3,4-thiadiazol-2(3H)-one.

Trade name(s): Supracide and Ultracide.

Formulations: Wettable powder, 25% ai.

Physical/Chemical properties:

Molecular formula: $C_6H_{11}N_2O_4PS_3$.
Molecular weight: 302.3 g/mol
Physical state: Colorless crystals.
Melting point: 39-40°C.
Vapor pressure (20°C): 2.48×10^{-6} mm Hg
Solubility (20°C): 250 mg/L water;
690 g/kg acetone;
850 g/kg cyclohexanone;
260 g/kg ethanol;
53 g/kg octan-1-ol;
600g/kg xylene.
Henry's Law Constant: 3.97×10^{-9} atm m^3/mol
Octanol/Water Partition Coefficient: 295 at pH 6.1

B. Status of Environmental Fate Data Requirements:

The status of most of the environmental fate data requirements provided below is tentative due to issues identified by EFED relatively late in the data collection and re-registration process. The tentative status provided below differs substantially from the last reported status by EFED. The status of the fate data requirements will be made more definitive in the final RED Chapter after EFED has met with the registrant to discuss a number of the more recently identified issues.

One of the major factors responsible for EFED changing the status of the laboratory data requirements was the failure in all of the laboratory studies to label the phosphorothioate portion of the molecule in addition to the thiadiazole ring. EFED has indicated below that to completely fulfill various laboratory fate data requirements, additional studies be conducted with the phosphorothioate portion of the molecule labeled. However, it may be possible for the registrant to satisfy these additional data requests with a literature review on the phosphorothioate portion of the molecule without additional laboratory studies. That is one of the areas that will be discussed with the registrant in a future meeting.

The tentative status of the environmental fate data requirements are as follows:

161-1. Hydrolysis: partially satisfied by acceptable study 4037701[(1)]
161-2. Direct Photolysis in Water: not satisfied; may become partially satisfied if unacceptable study 42081709 is upgraded[(2)]
161-3. Photodegradation on Soil: not satisfied; may become partially satisfied if unacceptable study 42081710 is upgraded[(3)]

162-1. Aerobic Soil Metabolism: partially satisfied by acceptable study 44545101[(4)]
162-2. Anaerobic Soil Metabolism: not satisfied; may become partially satisfied if supplemental study 42262501 is upgraded[(5)]
163-1. Adsorption/Desorption: partially satisfied by study 00158529[(6)]
164-1. Terrestrial Field Dissipation: not satisfied; may be partially satisfied by supplemental studies 41924401 and 41924402 if additional major degradates beyond the one monitored for in those studies (GS-12956 and GS-13007) are not present in the additional laboratory studies that have been required[(7)]
165-4. Accumulation in Fish: waived; although the Forbis, Georgie, and Bunch 1985 supplemental study (00158532) does not technically satisfy the 165-4 data requirement, requiring any additional 165-4 data is not warranted because of the low BCFs reported for total radiolabeled residues

Because methidathion appears to have substantial runoff potential, EFED recommends that aerobic aquatic metabolism (162-3) and anaerobic aquatic metabolism (162-4) studies also be conducted.

[(1)] 161-1. Hydrolysis: Although study 42037701 is acceptable, EFED now views it as only partially rather than completely satisfying the hydrolysis data requirement because only the thiadiazole ring portion of the molecule was labeled. To completely satisfy the data requirement, an acceptable study should also be provided in which the test compound has a radiolabel on the phosphorothioate side of the phosphorothioester (P-S-C)linkage.

[(2)] 161-2. Direct Photolysis in Water: Study 42081709 has been at least temporarily downgraded by EFED from acceptable to unacceptable. The study can probably be upgraded to partially satisfy the direct photolysis in water data requirement if the discrepancy between the reported susceptibility of methidathion to direct photolysis and an apparent lack of overlap between the absorption spectrum of methidathion and the irradiation spectrum of the filtered xenon lamp can be resolved. To help upgrade the study, the registrant should expand the study discussion to explore possible reasons for observing what appears to be a light catalyzed hydrolysis in the absence of any apparent overlap between the absorption spectrum of methidathion and the irradiation spectrum of the xenon lamp. Possibilities which should be explored include:

(a) The possibility that methidathion does absorb above 290 nm despite the absorption spectrum provided which does not clearly show absorption above 290 nm. If methidathion does absorb at wavelengths above 290 nm, the molar absorptivity of methidathion at wavelengths above 290 nm should be provided. Such values are necessary to help relate xenon lamp half-lives to solar half-lives.

(b) The possibility that the filtered irradiation spectrum of the xenon lamp could have extended below 290 nm despite the irradiation spectrum provided.

(c) The possibility that the methanol co-solvent and/or associated impurities could have shifted the absorption spectrum of the methidathion or acted as photosensitizers.

(d) The possibility there may have been chemical impurities or elevated concentrations of microorganisms in the irradiated water not in the dark control that catalyzed the hydrolysis rate in the irradiated solution.

(e) The possibility that one or more hydrolytic degradates are acting as photosensitizers.

Comparable reported temperatures in the irradiated and dark control solutions appear to rule out temperature differences as the cause for enhanced rates of hydrolysis in the irradiated solution.

If it is concluded that methidathion degraded by direct photolysis and molar absorptivities can be provided for methidathion above 290 nm, the half-life and photolysis rate constant computations in study 42081709 should be changed as follows to help upgrade the study:

(a) The rate constant for the dark control should be subtracted from the overall xenon lamp irradiated rate constant to give a xenon lamp direct photolysis rate constant.

(b) Solar direct photolysis in water rate constants at various latitudes and for various seasons should be computed from the xenon lamp direct photolysis rate constant using the following equation:

$k_{solar} = k_{xenon}\,[\Sigma\epsilon_{\lambda j} I_{\lambda j(solar)}\Delta\lambda_j / \Sigma\epsilon_{\lambda j} I_{\lambda j(xenon)}(1\text{ nm})]$ (Equation 1)
where,

k_{solar} = direct photolysis in water rate constant under solar irradiation
k_{xenon} = direct photolysis in water rate constant under xenon lamp irradiation
Σ = summation over the 290 to 600 nm range of UV-visible solar irradiation at the earth's surface
$\epsilon_{\lambda j}$ = molar absorptivity of the chemical at wavelength λ_j
$I_{\lambda j(solar)}$ = mean daily solar irradiation/nm at wavelength λ_j which varies with latitude and season
$\Delta\lambda_j$ = wavelength interval of 2.5 to 50 nm centered at wavelength λ_j
$I_{\lambda j(xenon)}$ = mean daily xenon lamp irradiation/nm at wavelength λ_j to which the chemical was exposed

Values of $I_{\lambda j(solar)}\Delta\lambda_j$ for various latitudes and seasons can be obtained from tables attached to OPPT guideline 835.2210. Note that in those tables, $I_{\lambda j(solar)}\Delta\lambda_j$ is referred to as $L_{\lambda j}$ where

$L_{\lambda j}$ = mean daily solar irradiation over wavelength interval $\Delta\lambda_j$ centered at wavelength λ_j

Once direct photolysis rate constants have been obtained, the corresponding half=lives can as always be obtained from the following equation:

$t_{1/2(direct\ photo)} = \ln 2/k_{direct\ photo}$ (Equation 2)

If study 42081709 is acceptably upgraded as previously described, the study can be used to partially satisfy the direct photolysis in water data requirement by providing information on the decline of the parent and on the formation and decline of degradates that contain the labeled thiadiazole ring. However, to completely satisfy the data requirement, a study should also be provided in which the test compound has a radiolabel on the phosphorothioate side of the phosphorothioester (P-S-C)linkage.

[(3)] 161-3. Photodegradation on Soil: Study 42081710 has been at least temporarily downgraded by EFED from acceptable to unacceptable. The study could possibly be upgraded to partially satisfy the photodegradation in soil data requirement if the discrepancy between slow to negligible non-photolytic degradation rates in the irradiated and dark control soil of the photodegradation study and the 3-11 day half-lives in the aerobic soil metabolism studies can be resolved. The results showing an apparent (though very moderate) susceptibility of methidathion to photodegradation on soil is based on a comparison of a relatively long half-life in the irradiated soil (40.6 days based on a 12 hour light:dark cycle) to no significant degradation in the dark control soil. By comparison, EFED calculated half-lives of 11.3 days and 3.1 days in aerobic soil metabolism studies 44545101 and 42262501, respectively. The stability of methidathion in the dark control compared to relatively rapid dissipation of methidathion in the aerobic soil studies casts substantial uncertainty on the reported results that methidathion is slightly susceptible to photodegradation on soil. EFED is not very concerned over uncertainty in the photodegradation on soil rate if it is indeed slow compared to other dissipation pathways such that photodegradation on soil is only a minor dissipation pathway. However, EFED is concerned over the possibility that whatever soil characteristics made methidathion stable in the dark control and only slowly susceptible to degradation in the irradiated soil (such as possibly inadequate soil moisture and/or a loss of soil viability) may have substantially altered soil structure and/or components such that the rate of photodegradation on soil may have been inhibited.

To upgrade study 42081710 to partially satisfy the photodegradation on soil data requirement, the registrant should:

(a) Provide plausible explanations on why the test chemical was stable in the dark control over a 30 day period and degraded with a half-life of 41 days in the irradiated soil compared to EFED computed half-lives of 11.3 days and 3.1 days in aerobic soil metabolism studies. If the discrepancy is due to inadequate soil moisture, the study cannot be upgraded.

(b) Solar photodegradation on soil rate constants at various latitudes and for various seasons should be computed from the xenon lamp direct photolysis rate constant using the following equation:

$$k_{solar(soil)} = k_{xenon(soil)} \left[\Sigma I_{\lambda j(solar)} \Delta\lambda_j / \Sigma I_{\lambda j(xenon)}(1\text{ nm})\right] \quad \text{(Equation 3)}$$

where,

$k_{solar(soil)}$ = photodegradation on soil rate constant under solar irradiation
$k_{xenon(soil)}$ = photodegradation on soil rate constant under xenon lamp irradiation
$I_{\lambda j(solar)}$ = mean daily solar irradiation/nm at wavelength λ_j which varies with latitude and season
$\Delta\lambda_j$ = wavelength interval of 2.5 to 50 nm centered at wavelength λ_j
$I_{\lambda j(xenon)}$ = mean daily xenon lamp irradiation/nm at wavelength λ_j to which the chemical was exposed

Values of $I_{\lambda j(solar)}\Delta\lambda_j$ for various latitudes and seasons can be obtained from tables attached to OPPT guideline 835.2210. Note that in those tables, $I_{\lambda j(solar)}\Delta\lambda_j$ is referred to as $L_{\lambda j}$ where

$L_{\lambda j}$ = mean daily solar irradiation over wavelength interval $\Delta\lambda_j$ centered at wavelength λ_j

Note that unlike equation 1 for the direct photolysis rate constant, equation 3 for the photodegradation on soil rate constant does not contain the molar absorptivities of the test chemical. The reason is that photodegradation on soil processes can include indirect photodegradation as well as direct photolysis.

Once rate constants have been obtained, the corresponding half-lives can as always be obtained from the following equation:

$t_{1/2(soil\ photo)} = \ln 2/k_{soil\ photo}$ (Equation 4)

If study 42081710 is acceptably upgraded as previously described, the study can be used to partially satisfy the photodegradation in soil data requirement. These studies provide information on the decline of the parent and on the potential formation and decline of degradates that contain the labeled thiadiazole ring. To completely satisfy the data requirement, a study should also be provided in which the test compound has a radiolabel on the phosphorothioate side of the phosphorothioester (P-S-C)linkage.

[(4)] <u>162-1. Aerobic Soil Metabolism:</u> Although study 44545101 is acceptable, EFED now views it as only partially rather than completely satisfying the aerobic soil metabolism data requirement because only the thiadiazole ring portion of the molecule was labeled. To completely satisfy the data requirement, a study should also be provided in which the test compound has a radiolabel on the phosphorothioate side of the phosphorothioester (P-S-C)linkage.

[(5)] <u>162-2. Anaerobic Soil Metabolism:</u> Study 42262501 has been classified as supplemental, but it could possibly be upgraded to partially satisfy the anaerobic soil metabolism data requirement. To upgrade the study, the TLC results must be correlated to the HPLC results to more clearly define the formation and decline of degradates. However, even if the study is acceptably upgraded, it can only partially satisfy the anaerobic soil metabolism data requirement because only the thiadiazole ring portion of the molecule was labeled. To completely satisfy the data requirement, a study should also be provided in which the test compound has a radiolabel on the phosphorothioate side of the phosphorothioester (P-S-C)linkage.

[6] 163-1. Adsorption/Desorption: Study 00158529 partially satisfies the adsorption/desorption data requirement by providing Freundlich adsorption and desorption binding constants and exponents for methidathion on 4 test soils. To completely satisfy the data requirement, the same type of information should be provided for all major degradates identified in any of the laboratory degradation studies.

[7] 164-1. Terrestrial Field Dissipation

There were no major degradates identified in the acceptable aerobic soil metabolism study 44545101. In the supplemental aerobic soil metabolism study 42262501, one major degradate (unknown 1) was isolated at a maximum of 13.4% of applied. However, even though its structure was tentatively identified, its identity could not be firmly established or confirmed despite extensive MS work to do so. In supplemental anaerobic soil metabolism study, unknowns 1 (same compound as above) and 3 came close to be classified as major degradates, but their maximums were just under 10% of applied.

If the additional laboratory work and/or literature review reveals no other likely major degradates in soil under aerobic or anaerobic conditions, EFED will upgrade supplemental studies 41924401 and 41924402 to partially satisfy the terrestrial field dissipation data requirement by providing information on the persistence and mobility of methidathion in cropped and bare plot citrus groves in California. Although several detections of methidathion in the 12-18 inch cores in those studies were probably due to sample contamination, the study nevertheless shows that methidathion did not move below 18 inches. Furthermore, even if minor contamination also occurred in the top 0-6 inch cores, it is unlikely to have substantially affected the reported dissipation rates for methidathion in the 0-6 inch cores which were based primarily upon decreasing concentrations much greater than the contamination level.

To completely satisfy the terrestrial field dissipation data requirement, the registrant should conduct an additional study in California on cropped and bare plot cotton fields. Before performing the study, the registrant should consult with EFED concerning degradates (if any) for which monitoring should be performed. Any other major degradates (if any) in soil that may be identified as the result of additional laboratory work and/or literature review should be included in the monitoring. In addition, EFED would like to discuss with the registrant the possibility of further establishing and confirming the identity of unknown 1 so that it can be included in the monitoring.

C. Environmental Fate and Transport Assessment

Methidathion is foliarly applied to a variety of terrestrial food crops and to nursery stock. It is subject to spray drift at the time of application to nearby non-target areas including surface water bodies. Spray drift is (in general) far more substantial for aerial applications than for spray blast or ground applications. Spray drift generally increases with decreasing droplet size distribution and is of course greater for areas directly downwind than for other areas.

In a published article, Willis and McDowell 1987 reported mean foliar dissipation half-lives for methidathion of 0.5 days (cotton), 0.6 days (cotton), 0.3 days (cotton), 3.5 days (alfalfa), and 5.0 days (alfalfa). The three cotton half-life values (0.5, 0.6, and 0.3 days) were based on measurements of the dislodgeable residue. The first two were done in Arizona at temperature of 27ºC, and the third one was done in Texas, where no temperature was reported. The half-life of 3.5 days was done for alfalfa based on the total residue where no environmental conditions were reported. The half-life of 5.0 days was done for clover based on the total residue where no environmental conditions were reported. These half-life values were compiled by Willis and McDowell based on their literature search. For the terrestrial exposure assessment purpose, without a validated foliar dissipation study, the soil aerobic metabolism half-life of 11.3 days was used in the FATE program to provide conservative estimated exposure values.

The relatively low octanol/water partition coefficient for methidathion of 295 suggests that it will only moderately partition into the waxy component of leaves. Moderate partitioning into the waxy components of leaves suggests that the remaining methidathion at the time of a post-application rainfall event may have a substantial washoff potential. However, the relatively short foliar dissipation half-lives of methidathion indicate that a substantial mass of methidathion will washoff onto the soil only if appreciable rainfall events occur within one to several days post-application.

At the time of foliar application, substantial amounts of applied methidathion could reach exposed soil and (to a lesser extent) penetrate the canopy to reach canopy shielded soil. It can also reach soil via washoff during post-application rainfall events.

The reported Freundlich binding constants for methidathion in acceptable study 00158529 should be somewhat comparable to soil/water partition coefficients because the Freundlich exponents $\geq$ 0.84. The relatively low to moderate soil/water partitioning of methidathion (Freundlich binding constants 2.5-16) indicates that the methidathion reaching soil may have limited to moderate potentials for leaching and uptake by plants, and moderate to substantial potentials for runoff depending upon the soil and other conditions. However, EFED calculated overall half-lives of 11.3 and 3 days in acceptable and supplemental aerobic soil metabolism studies 44545101 and 42262501, respectively. A half-life of 10 days was reported for methidathion in supplemental anaerobic soil metabolism study 42262501. Therefore, substantial fractions of the methidathion reaching soil may degrade and no longer be available for such physical removal processes within 1-3 weeks after reaching the soil.

Chemicals found in groundwater typically exhibit soil/water partition coefficients < 5, and the most frequently detected ones typically exhibit soil/water partition coefficients < 1. The soil/water partition exhibited by methidathion is borderline with respect to leaching to ground water with most Freundlich binding constants < 5, but some substantially > 5, and all > 1. The relatively short half-lives reported for methidathion in laboratory soil studies compared to the time it would probably take methidathion to reach most ground water may also somewhat limit the amount of methidathion reaching ground water. However, most of the removal of methidathion in the laboratory metabolism studies appears to be due to biodegradation. Methidathion is only moderately susceptible to abiotic hydrolysis (study 42037701) and its volatilization from soil in the lab studies (including supplemental laboratory volatilization study 42098801) was negligible to moderate. Because microbiological populations and activities generally decrease rapidly with depth in soil, any methidathion leaching below the top soil layers will probably be much more persistent in the sub-strata than it is in the top soil layers.

In supplemental CA and NE terrestrial field dissipation studies (40094103, 41924401, 41924402), methidathion had reported dissipation half-lives in the top 6 inches of 4.8, 9.2, < 14, 15, and 15-30 days. The reported half-lives of < 14 days (in CA) and 15-30 days (in NE) in supplemental study 40094103 are highly uncertain because they are based one or two data points, respectively, instead of regressions over all of the data points (see data summary). Methidathion was not detected at depths below 18 inches in the field studies. There were several detections of methidathion in samples collected from the 12-18 inch cores. However, such detections appear to have been due to contamination because they occurred in samples collected before any irrigation or rainfall event occurred.

Because microbiological populations and activities in ground water are also usually relatively low, the degradation rates of any methidathion reaching ground water will probably generally be closer to its generally moderate abiotic hydrolysis rates (equivalent to 13-48 day half-lives) than to the faster rates reported for the soil metabolism studies (equivalent to 3.1-11.3 day half-lives.

The persistence of dissolved methidathion in the water column of surface waters receiving methidathion via spray drift and/or runoff will depend upon numerous factors including the hydrologic residence time and pH of the water and the microbiological populations and activities within the water. The relatively low to moderate soil/water partitioning (Freundlich binding constants 2.5-16) and low Henry's Law constant (3.97×10^{-9} atm*m^3/mol) exhibited by methidathion indicate that rates of adsorption to sediment or of volatilization will probably not contribute substantially to the overall dissipation rate of dissolved methidathion in the water column. In waters with short hydrological residence times and/or substantial microbiological activity, the half-life or DT50 of methidathion may be substantially less than two weeks due to advection and/or biodegradation. In waters with long hydrological residence times and low microbiological activities the half-life or DT50 of dissolved methidathion may be substantially longer and even approach the reported abiotic hydrolysis half-lives of 37, 48, and 13 days in pH 5, 7, and 9 waters, respectively (acceptable hydrolysis study 42037701).

It is currently unclear whether direct photolysis can contribute significantly to the overall dissipation rate of methidathion in the water column under some conditions. In direct photolysis in water study 42081709, a continuous xenon lamp irradiated half-life of 11.6 days (reportedly approximately equivalent to 8.2 days solar irradiation during the equinox at 40^0 N latitude) in distilled water was reported for methidathion compared to a dark control of 46 days. However, there was no apparent overlap between the absorption spectrum of methidathion and the irradiation spectrum of the xenon lamp or of sunlight at the earth's surface. Even if it is finally concluded that methidathion is susceptible to direct aqueous photolysis, the process will probably contribute significantly to the overall dissipation rate only in clear shallow water. The reason is that even in relatively pristine water, light attenuation increases steeply with depth due to refraction and absorption of light by various constituents in the water.

Although methidathion exhibits relatively low to moderate soil/water partitioning, Freundlich binding constants between 2.5 and 16 indicate that at equilibrium, concentrations of methidathion in the sediment may be several fold greater than in water with which it is in equilibrium. Although the bottom sediment of many surface waters is somewhat anaerobic, the bottom sediment of shallow well aerated streams is often aerobic. Regardless of the redox potential of the sediment, methidathion in bottom sediment may exhibit comparable degradation rates because the half-lives in both the aerobic soil metabolism studies (3.1 and 11.3 days) and in the anaerobic soil metabolism study (10 days) were comparable.

Based on labeling only the thiadiazole ring portion of the methidathion molecule, the only major degradates identified in the laboratory studies were 5-methyl-1-3,4-thiadiazol-2 (3H)-one (GS-12956) and des-methyl S-[(5-methoxy-2-oxo-1, 3, 4-thiadiazol-3 (2-1)-yl-methyl 0,0-dimethyl phosphorothioate (des-methyl GS-13007). The GS-12956 molecule was a major degradate in the hydrolysis study at all 3 experimental pHs (5, 7, and 9) and in the direct photolysis in water study. The des-methyl GS-13007 molecule was a major degradate in pH 9 solution of the hydrolysis study. No major degradates were identified or isolated in the acceptable aerobic soil metabolism study. One unknown major degradate (unknown 1) was isolated in the supplemental aerobic soil metabolism study at a maximum of 13.4% of applied. The same unknown was isolated at a maximum of 9% of applied in the supplemental anaerobic soil metabolism study. Although the identity of unknown 1 was not firmly established or confirmed, the registrant tentatively characterized the structure of unknown 1 as a cyclic compound formed from the reaction of carbazic acid and cysteine.

The available data are insufficient to adequately characterize the persistence and mobility of the degradates of methidathion. No adsorption/desorption data have been submitted for any of the degradates isolated from laboratory studies to date including major degradates GS-12956, desmethyl GS-13007, or unknown 1. A major hydrolysis degradate (GS-12956) was monitored for in two CA field dissipation studies as was a minor aerobic soil metabolism degradate (GS-13007 which is the oxygen analog of methidathion). GS-12956 was detected above a detection limit of 50 ppb in only a small number of samples none of which were collected below 6 inches. GS-13007 was detected only once above a detection limit of 20 ppb in a sample from a 18-24 inch core.

In a supplemental moderately aged (3 days) soil column leaching study (00158528), 77.2%, 18%, 6.6% and 15.5% of total applied ^{14}C methidathion residues (thiadiazole ring labeled at the carbonyl carbon) leached through 12 inch sand, silt loam, sandy loam, and silty clay loam columns, respectively. Although the results of the study demonstrate some mobility of total methidathion residues, the total residues were not further separated and analyzed to determine what fractions of the total radiolabeled residues in the leachates were represented by the parent and various degradates. It should also be noted that the columns used were relatively short (12 inches) thereby resulting in larger percentages of applied in the leachates than with more typically used columns which range up to 30 inches in length.

D. Data Summary

Note that in all of the laboratory degradation studies discussed below, only the thiadiazol ring carbonyl carbon contained a radiolabel. None of the molecule on the phosphorodithioic side of the thioester linkage was radiolabeled. Consequently, any phosphorodithioic degradates formed from the cleavage of the thioester linkage such as the O,O,S -trimethyl ester of phosphorodithioic acid could not be followed. Although such degradates can be reasonably postulated to occur from the cleavage of the thioester linkage (as was done by the registrant), it is not possible to estimate the maximum levels of such degradates or the rates of decline without proper radiolabeling.

All of the data summaries provided below are for acceptable or supplemental studies except direct photolysis in water study (42081709). Although unacceptable studies are generally not included in data summaries, study 42081709 has been included because it has a high probability of being upgraded to acceptable or supplemental.

In the data summaries provided below, degradates are referred to by their registrant supplied identification names such as GS-12956 rather than their chemical names such as 5-Methoxyl-1,3,4-thiadiazol-2(3H)-one. However, a list of all degradates identified in laboratory studies to date is provided in the following table along with their chemical names, and the process and compartment that resulted in the formation of the degradate.

Table : Identification and Source of Methidathion Metabolites		
I. D. Number	Chemical Formulas	Process & Compartment that Resulted in the Formation of this Degradate
GS-12956	5-methoxy-1,3,4- thiadiazol-2-(3H) one	hydrolysis; aerobic soil metab. ; anaerobic soil met.; photolysis in water; photolysis on soil
GS-13007	S-[(5-methione-2-oxo-1,3,4-thiodiazol-3(2H)-yl methyl o,o dimethyl phosphoro thioate	hydrolysis aerobic soil metab.
GS-28370	5 methoxy-3-[(methyl- sulfinyl methyl]-1,3,4-thiodiazol-2-(3H)one	aerobic soil metab.
GS-28369	5 methoxy-3-[(methyl sulfonyl)methyl]-1,3,4-thiodiazol-2(3H)-one	aerobic soil metab. soil column leaching anaerobic soil met.
GS-20685 and GS12956	Unknown 5-methoxy-1,3,4- thiadiazol-2-(3H) one	aerobic soil metabol.

161-1. Hydrolysis: In an acceptable study (42037701), methidathion degraded with half-lives of 37 days at pH 5, 48 days at pH 7, and 13 days at pH 9 in sterile aqueous buffers incubated in the dark at 24-25^{0}C. Using only a thiadiazol ring radiolabel, the only major degradate isolated and identified in the pH 5 and pH 7 solutions was 5-Methoxyl-1,3,4-thiadiazol-2(3H)-one (GS-12956). In the pH 5 solution, GS-12956 reached a replicate averaged maximum of 41.9% of applied on the last day of the study (day 35). In the pH 7 solution, GS-12956 reached a replicate averaged maximum of 29.6% of applied on the last day of the study (day 32).

GS-12956 was also a major degradate in the pH 9 solution along with desmethyl S-[(5-methoxy-2-oxo-1,3,4-thiadiazol-3(2H)-yl)-methyl O,O-dimethyl phosphorothioate (des-methyl GS-13007).

In the pH 9 solution, GS-12956 reached a replicate averaged maximum of 39.4% on day 15 and was a replicate average 35.2% of applied on the last day of the study (day 20). Desmethyl GS-13007 reached a replicate averaged maximum of 20.6% of applied on the last day of the study (day 20).

161-2. Direct Photolysis in Water: In an unacceptable, but probably upgradable study (42081709), methidathion degraded with a half-life of 11.6 lamp days (equivalent to 8.2 days of sunlight) in sterile aqueous buffered (pH 7) solutions that were continuously irradiated for 15 days with a xenon lamp at 23.9-25.8 C. The degradation half-life in dark control samples was 45.9 days. Using only a thiadiazole ring label, the only degradate isolated and identified was GS

12956, which was a major degradate in both the irradiated and dark control solutions. On the last day of the study (day 15), GS-12956 reached replicate averaged maximums of 51% and 22.3% of applied in the irradiated and dark control solutions, respectively. The study is currently viewed as unacceptable for use in the fate assessment because of the discrepancy between the reported susceptibility of methidathion to direct photolysis and an apparent lack of overlap between the absorption spectrum of methidathion and the irradiation spectrum of the filtered xenon lamp.

161-3. Photodegradation on Soil Study 42081710 has been at least temporarily downgraded by EFED from acceptable to unacceptable. The study could possibly be upgraded to partially satisfy the photodegradation in soil data requirement if the discrepancy between slow to negligible non-photolytic degradation rates in the irradiated and dark control soil of the photodegradation study and the 3-11 day half-lives in the aerobic soil metabolism studies can be resolved. The results showing an apparent (though very moderate) susceptibility of methidathion to photodegradation on soil is based on a comparison of a relatively long half-life in the irradiated soil (40.6 days based on a 12 hour light:dark cycle) to no significant degradation in the dark control soil. By comparison, EFED calculated half-lives of 11.3 days and 3.1 days in aerobic soil metabolism studies 44545101 and 42262501, respectively. The stability of methidathion in the dark control compared to relatively rapid dissipation of methidathion in the aerobic soil studies casts substantial uncertainty on the reported results that methidathion is slightly susceptible to photodegradation on soil. EFED is not very concerned over uncertainty in the photodegradation on soil rate if it is indeed slow compared to other dissipation pathways such that photodegradation on soil is only a minor dissipation pathway. However, EFED is concerned over the possibility that whatever soil characteristics made methidathion stable in the dark control and only slowly susceptible to degradation in the irradiated soil (such as possibly inadequate soil moisture and/or a loss of soil viability) may have substantially altered soil structure and/or components such that the rate of photodegradation on soil may have been inhibited.

For information on how to upgrade study 42081710 to partially satisfy the photodegradation on soil data requirement, please see section **B. Status of Environmental Fate Data Requirements**

162-1. Aerobic Soil Metabolism: In an acceptable aerobic soil metabolism study (44545101), methidathion degraded with an EFED computed overall half-life of 11.3 days in a Hanford sandy loam soil. There were no major degradates isolated or identified. Minor degradates isolated and identified were GS-20685, GS-12956, GS-28369, GS-28370, and GS-13007. The maximum percentages of applied represented by the minor degradates were all less than 2.6%. Nine unidentified areas of radioactivity totaled 4.3% of the applied radioactivity. Unextractable residues comprised a maximum of 34.8% of the applied at 30 days. Radiolabeled carbon dioxide accounted for 16.7% of the applied radioactivity at 7 days and gradually increased to a maximum of 33% at 30 days posttreatment.

In a supplemental aerobic soil metabolism study (42262501), methidathion degraded with an overall half-life of 3.1 days in nonsterile sandy loam soil. One major degradate (unknown 1) was isolated which reached a maximum of 13.4% of applied on day 11 and declined to 9.9% of applied on last day of the study (day 263). Although the identity of unknown 1 was not firmly established or confirmed, the registrant tentatively characterized the structure of unknown 1 as a cyclic compound formed from the reaction of carbazic acid and cysteine.

Minor degradates isolated and identified were GS-12956, GS-28369, and GS-28370. The maximum percentages of applied represented by the minor degradates were all less than 2.2%.

During the 263-day experiment, organic volatiles and CO_2 totaled $\leq$0.1 and 58.7% of the applied, respectively. Residues that could not be extracted from the soil with methanol:water were a maximum of 30.3-37.5% of the applied at 11 days, then slowly decreased to 20.2-22.8% by 263 days.

162-2. Anaerobic Soil Metabolism: In a supplemental anaerobic soil metabolism study (42262501), methidathion degraded with a half-life of 10.0 days in nonsterile flooded sandy loam soil that was incubated under a nitrogen atmosphere for 65 days following 3 days of aerobic incubation. The majority of the extractable methidathion residues were recovered in the floodwater, rather than the methanol:water soil extracts.

No major degradates were isolated. However, unknowns 1 and 3 came close to being classified as major degradates reaching maximums of 9.0% (on day 62) and 9.5% (on day 30) of applied, respectively. Unknown 1 was the same compound characterized in the supplemental aerobic soil metabolism study 42262501 as a cyclic compound formed from the reaction of carbazic acid and cysteine.

Minor methidathion degradates identified were GS-28369 (reached a maximum of 2.5% of applied on the last day - day 65) and GS-12956 (reached a maximum of 4.9% of applied on the last day - day 65). During the 65-day experiment, organic volatiles and CO_2 totaled $\leq$0.1 and 22.4% of the applied, respectively. Methidathion residues that could not be extracted from the soil with methanol:water were 27.0-34.9% of the applied.

163-1. Adsorption/Desorption: In an acceptable adsorption/desorption batch equilibrium study (00158529), Freundlich adsorption and desorption binding constants and exponents were determined for methidathion on a sand, loamy sand, sandy clay loam, and loam. The properties of the test soils and the Freundlich adsorption and desorption binding constants and exponents are listed in the following table.

Soil series	**Texture**	**% OM**	**pH**	**K*ads***	**Kd*des***	**1/N ads**	**1/N des**
Lakeland	Sand	1.2	6.3	4.1	5.87	0.86	0.82
Collomb	Loamy sand	2.2	7.8	2.48	3.18	0.84	0.86
Vetroz	Sandy clay loam	5.6	6.7	14.83	15.8	0.88	0.91

Les Evo.	Loam	3.6	6.1	4.53	5.69	0.88	0.89

163-1. Soil Column Leaching: Supplemental study 00158528
In a supplemental aged soil column leaching study, aged (3 days) total ^{14}C-methidathion residues were eluted down 12 inch sand, silt loam, sandy loam, and silty clay loam columns. Methidathion was applied at 0.1 mg/column and leached with 20 inches of water over periods ranging from 20 hours to 6 days. Total ^{14}C-methidathion residues were detected throughout the columns, and 77.2, 18.0, 6.56, and 15.5% of the applied were detected in the leachate from the sand, silt loam, sandy loam, and silty clay loam soil columns, respectively. Residues were not characterized in this study, e.g., the relative contribution of the parent and the major degradates to the total residues and the leachate were not determined.

163-2. Laboratory Volatility: Supplemental study 42098801.
In a preliminary experiment conducted for 14 days, [^{14}C]volatiles from duplicate samples of Huntington Loamy Sand from Kentucky totaled 28.0 and 29.1% of the applied radioactivity, of which 99% (27.7-28.7% of the applied) was $^{14}CO_2$. In an experiment conducted for 30 days on the same soil, [^{14}C]volatiles from four samples totaled 10.7, 11.5, 13.1, and 13.4% of the applied radioactivity, of which 47-57% (6.2-7.6% of the applied) was $^{14}CO_2$. The rate of volatilization of total radiolabeled residues ranged from 3.4 x 10^{-4} ug/cm^2/hr to 6.3 x 10^{-4} ug/cm^2/hr. No volatile [^{14}C]compound other than $^{14}CO_2$ was identified.

164-1: Terrestrial Field Dissipation: In supplemental study 40094103, methidathion (2EC) dissipated with half-lives of 15-30 days (0-6" depth) and <14 days (0-6" depth) in California field plots of sandy loam soil following each of two separate applications of methidathion at 5.0 lbs ai/A in 1984 and 1985, respectively. The half-lives of methidathion were <15 days in Nebraska field plots of silty clay loam soil following each of two separate applications of methidathion at 5.0 lbs ai/A in 1984 and 1985. The reported half-lives of < 14 days (in CA) and 15-30 days (in NE) in supplemental study 40094103 are highly uncertain because they are based one or two data points, respectively, instead of regressions over all of the data points. In the 40094103 CA study, over 50% of methidathion had dissipated in the first post-application sample collected at 14 days. In the 40094103 NE study, less than 50% and more than 50% of methidathion had dissipated in the first and second post-application samples collected at days 15 and 30, respectively.
Residues were not detected at depths below the 0-6" layer at any sampling interval at either of the sites. The degradate GS-13007 (the oxygen analog of methidathion) was not detected in the soil from either site at any sampling interval. Patterns of formation and decline of degradates were not adequately addressed, depth of leaching was not defined, and field test data were incomplete. In addition, methidathion was soil incorporated at both sites, which is not a typical method of methidathion application.

In supplemental study 41924401, methidathion in the form of a emulsible concentrate was ground sprayed twice on to citrus groves on a CA sandy loam soil (om% = 0.92, pH = 7.4) at an application rate of 5.5 lb ai/acre for each application. The interval between applications was approximately 6 weeks. During the study, precipitation and irrigation totaled 11.9 and 38.30

inches respectively. After the second application, methidathion dissipated in the top 6 inches of soil with a half-life of 9.2 days. Methidathion was detected to a depth of 18 inches, but that was probably due to contamination because such detections occurred shortly after application before any post-application rainfall or irrigation occurred.

The only degradates monitored for in study 41924401 were GS-12956 (a major hydrolytic degradate) and the minor degradate GS-13007 (the oxygen analog of methidathion). GS-13007 was detected once in an 18-24 inch core. GS-13007 was detected to a depth of 24", and GS-12956 was detected to a depth of 18".

In supplemental study 41924402, methidathion in the form of a emulsible concentrate was ground sprayed once on to bare plots on a CA sandy loam soil (om% = 0.92, pH = 7.4) at an application rate of 10 lb ai/acre. During the study, precipitation and irrigation totaled 11.9 and 38.30 inches respectively. Methidathion dissipated in the top 6 inches of soil with a half-life of 4.8 days. Methidathion was detected to a depth of 18 inches, but that was probably due to contamination because such detections occurred shortly after application before any post-application rainfall or irrigation occurred.

The only degradates monitored for in study 41924402 were GS-12956 (a major hydrolytic degradate) and the minor degradate GS-13007 (the oxygen analog of methidathion). GS-13007 was not detected at any sampling interval or depth. GS-12956 was detected several times in the 0-6 inch cores.

165-4. Bioaccumulation in Fish: In supplemental bioaccumulation in fish study 00158532, total ^{14}C-methidathion residues accumulated in bluegill sunfish with maximum bioconcentration factors of 19, 75 and 46x in edible tissues (body, muscle, skin, skeleton), nonedible tissues (fins, head, internal organs), and whole fish, respectively. The fish were exposed to ^{14}C-methidathion residues at 0.05 ppb in a flow through system for 28 days. Maximum levels of ^{14}C-residues were 1.0 ppb in edible tissues, 3.9 ppb in nonedible tissues, and 2.4 ppb in whole fish. After 14 days of depuration, ^{14}C-residues in edible and nonedible tissues and whole fish were <0.49, 0.52, and 0.49 ppb, respectively. Residues in the water and the fish were not characterized with respect to specific compounds such as the parent and various degradates

III. Environmental Exposure Assessment

A. Terrestrial Exposure

For pesticides applied as a nongranular product (e.g., liquid, dust), the estimated environmental concentrations (EECs) on food items following product application are compared to LC50 values to assess risk. The predicted 0-day maximum and mean residues of a pesticide that may be expected to occur on selected avian or mammalian food items immediately following a direct single application at 1 lb ai/A are tabulated below.

Table : Estimated Environmental Concentrations on Avian and Mammalian Food Items (ppm) Following a Single Application at 1 lb ai/A)

Food Items	EEC (ppm) Predicted Maximum Residue[1]	EEC (ppm) Predicted Mean Residue[1]
Short grass	240	85
Tall grass	110	36
Forage and small insects	135	45
Fruits, pods, seeds, and large insects	15	7

[1] Predicted maximum and mean residues are for a 1 lb ai/a application rate and are based on Hoerger and Kenaga (1972) as modified by Fletcher *et al.* (1994).

Predicted residues (EECs) resulting from multiple applications may be calculated in various ways. For this assessment, methidathion EECs were calculated using Hoerger and Kenaga (1972) as modified by Fletcher *et al.* (1994). These EECs served as the "initial concentration" inputs into the FATE program. The FATE program is a first order dissipation model, i.e., the pesticide is applied repeatedly, but degrades over time from the first application to the last application. The aerobic soil metabolism half-life of 11.3 days was used in the model. Please see Section **C. Environmental Fate and Transport Assessment** for a discussion on the selection of the foliar halflife value. EEC values for a variety of crops and application rates/methods are provided in the risk quotient tables in Section 4, “Ecological Risk Assessment.” The time period modeled varied depending on the number of applications and the interval between applications, and the length of time the EECs were expected to exceed the chronic risk LOC. The program generates a maximum value as well as an average value for the time period modeled. For the acute portion of the exposure assessment, the Hoerger and Kenaga value for the food item was entered into the FATE program. The maximum value was then compared to the acute toxicity value to produce the risk quotient. For chronic exposure, the Fletcher mean value for the food item was used as the initial input. Both the peak mean and time-weighted average mean EECs were used in the risk assessment.

B. Water Resources Assessment

I. Models and parameters used

For aquatic exposure assessment, both a tier I screening approach with GENeric Expected Environmental Concentration model (GENEEC) and tier II refinement approach with PRZM (Pesticide Root Zone Model) and EXAMS (EXposure Analysis Modeling System) were simulated. The aquatic exposure values were used for drinking water exposure from surface water. For drinking water from ground water sources, the Screening Concentration In GROund Water (SCI-GROW) model was used.

The environmental fate data for methidathion used in the tier 2 refined modeling are summarized in Table . Current EFED guidance for the selection of environmental half-lives for modeling purposes states that when results are available from more than one study, the upper 90% confidence interval should be used:

$$Value_{90} = mean + [t_{90} * SD/\sqrt{n}]$$

where: SD denotes standard deviation of the samples, n denotes the number of samples, and t_{90} denotes the upper 90% value based on student's *t* distribution. In the case of methidathion, the soil aerobic half-life values are 3.0 and 11.28 days, and the resulting upper 90% value is 19.9 Since there were no data for the foliar dissipation study, a zero decay rate was assumed for the foliar decay rate.

Table . Methidathion fate properties and values used in (GENEEC, PRZM3/EXAMs) modeling.

Parameter	Value	Source
Molecular Weight	302.3 g/mol	product chemistry
Water Solubility	250 mg/l	product chemistry
Partition Coefficient (Koc)	325 cm^3/g	MRID #00158529
Vapor Pressure	2.48×10^{-6} mm Hg	product chemistry
Hydrolysis Half-lives @ pH 4 pH 7 pH 9	37 days 48 days 13 days	MRID 42037701
Aerobic Soil Half-life	19.9 days	MRID #44545101, 4226501
Water Photolysis	11 days	MRID #42081709
Aerobic Aquatic Half-life	10 days	MRID #42262501

For EXAMS inputs, based on the aquatic photolysis half-life of 11 days, a value of 2.62×10^{-3} hr^{-1} was used for KDP. For the potential microbial degradation mechanisms, KBACW and KBACS are used to describe the water column bacterial biolysis and the benthic sediment bacterial biolysis, respectively. Since no aerobic or anaerobic aquatic metabolism data were available, a factor of 50% was used to convert the soil aerobic and aerobic rate constants used in PRZM to represent KBACW and KBACW. The values of 7.26×10^{-4} and 1.44×10^{-3} hr^{-1} were used for KBACW and KBACS, respectively.

a. PRZM

PRZM3.1 relates pesticide movement to temporal variations of hydrology, agronomy, pesticide chemistry and meteorology. In order to run PRZM, four types of input data are needed: meteorology, soil, hydrology and pesticide chemistry. Except for the pesticide chemistry, the other three types of input data were generated by using the PIRANHA (Pesticide and Industrial Chemical Risk Analysis and Hazard Assessment, developed by Burns, et al., 1992) software package.

Based on the rainfall records and crop productions, the modeling scenarios chosen to represent the high runoff potential are listed below:

Use	Site	MLRA*	Soil	Hydrologic Soil Group
Apples	Columbia County, NY.	144B	similar to Sharkey Clay	D
Citrus	Osceola County, FL.	156A	Adamsville Sand	C
Cotton	Yazoo County, MS.	134	Loring Silt Loam	C

*MLRA represents Major Land Resource Area, which are geographically associated land resource units (USDA, 1981).

The meteorology parameters including precipitation, evaporation and air temperature were based on the records from 1948 to 1983 of the weather stations at Concord, New Hampshire for apples, Orlando, Florida for citrus, and Jackson, Mississippi for cotton.

The soil properties including layer depth, soil texture class, soil composition (i.e., percentage sand, silt, clay, and organic matter), bulk density, field capacity, wilting point, and available water for each selected soil were extracted from PIRANHA databases.

b. EXAMS

The operation of EXAMS involved three types of data inputs: Environment, Load and Chemical. The standard Georgia farm pond data file was used to describe the Environment data input. The P2E-C1.D(X) [where "X" representing a two-digit number from 48 to 83], files generated by PRZM were used as the Load data input. The Chemical data input was created based on the E. Fate profile of methidathion.

EXAMS was run using data from 36 years using Mode 3 which used monthly environmental data and the daily pulse loads of runoff and spray drift. For each year simulated, the maximum annual peak, 96-hour average, 21-day average, 60-day average, 90-day average values, and the annual mean were extracted from the EXAMS output file REPORT.XMS with the TABLE20.EXE post-processor. The 10 year return EECs (or 10% yearly exceedance EECs) of apples, citrus, and cotton listed in Tables 2 to 4 were calculated by linear interpolation between the third and fourth largest values by the program TABLE20.EXE.

ii. Results

The post-processor, LOAD.EXE, was used to estimate the chemical contributions of runoff, erosion and spray drift to the standard farm pond. The results expressed as percentages are tabulated below:

Percent of Pesticide Loadings from Different Sources to the Standard Pond

Use	Runoff	Erosion	Spray Drift
Apples	47.83%	0.00%	52.17%
Citrus	58.55%	0.02%	41.43%
Cotton	64.93%	1.58%	33.50%

The erosion losses were the smallest among the three components. Any mitigation approaches should focus on reducing runoff volume and spray drift.

a. Aquatic EECs

The GENEEC results of peak and 56-day values are provided in Appendix . They are provided for both the maximum and the typical application rates as provided by the registrant in the SMART meeting on 9/29/97.

Because EEC values predicted by GENEEC pose potential aquatic concerns, a refined tier II approach with PRZM/EXAMS was implemented. The upper tenth percentile concentration values, expressed in ppb (ug/L), are summarized below. The results of three uses, apples, citrus, and cotton, were based on the standard scenarios provided by the Water Quality Tech Team (WQTT) to predict reasonable high exposure values, i.e., soils with high runoff potential and heavy rainfall amounts.

Use	Peak	96-hr average	21-d average	60-d average	90-d average
Apples	8.48	7.91	6.37	4.11	3.10
Citrus	26.51	24.60	18.87	11.45	8.38
Cotton	12.24	11.34	8.47	5.56	4.18

The modeling results indicate that methidathion does have the potential to move into surface waters, especially for citrus use. The estimated tier II maximum concentration of methidathion in surface water following one foliar application of 2.0 lb ai/ac is 26.51 ppb and the 60-day average concentration is 11.45 ppb. These estimates are based on a typical application rate. If the maximum citrus label rate of 2 applications at 5.0 lb ai/ac each is used, the EEC values will be even higher.

iii. Drinking Water Assessment

a. Ground Water

SCI-GROW is an empirical screening model based on actual ground water monitoring data collected from small-scale prospective ground water monitoring studies for the registration of a number of pesticides that serve as benchmarks for the model. The current version of SCI-GROW provides realistic estimates of pesticide concentrations in shallow, highly vulnerable ground water (i.e., sites with sandy soils and depth to ground water of 10 to 20 feet). There may be exceptional circumstances under which concentrations of a pesticide may exceed the SCI-GROW estimates; however, such exceptions should be rare since the SCI-GROW model is based exclusively on ground water concentrations resulting from studies conducted at sites (shallow ground water and coarse soils) and under conditions (high irrigation) most likely to result in ground water contamination. The ground water concentrations generated by SCI-GROW are based on the largest 90-day average concentration recorded during the sampling period. Because of the conservative nature of the monitoring data on which the model is based, SCI-GROW provides an upper bound estimate of pesticide residues in ground water. The SCI-GROW results shown below are based on the typical rates and the maximum rates.

Crop	Typical Rate: AI Applied (lb)	SCI-GROW Conc. (ppb)	Maximum Rate : AI Applied (lb)	SCI-GROW Conc. (ppb)
Almonds	1.5	0.0458	3	0.0916
Artichokes	2	0.0611	8	0.2442
Citrus	2	0.0611	10	0.3052
Cotton	1	0.0305	16	0.4884
Olives	1.5	0.0458	3	0.0916
Pome Fruits	1.5	0.0458	3	0.0916
Stone Fruits	1.5	0.0458	3	0.0916
Safflower	0.5	0.0153	1.5	0.0458
Walnuts	1.5	0.0458	9	0.2747

Methidathion has the use patterns and environmental fate characteristics associated with a compound that could leach to ground water. The maximum concentration estimated in ground water is 0.4884 ppb. That estimate from SCI-GROW represents an upper bound on the concentration of methidathion in ground waters as a result of cotton use.

b. Surface Water

The aquatic EEC values discussed previously for eco-risk concerns are also used for drinking water purpose. The estimated tier II maximum concentration of methidathion in surface water for citrus use following one foliar application of 2.0 lb ai/ac is 26.51 ppb and the 60-day average concentration is 11.45 ppb. These estimates are based on a typical application rate. If the maximum citrus label rate of 2 applications at 5.0 lb ai/ac each is used, the estimated drinking water values will be even higher.

IV. Ecological Effects Hazard Assessment

A. Toxicity to Terrestrial Animals

I. Birds, Acute and Subacute

An acute oral toxicity study using the technical grade of the active ingredient is required to establish the toxicity of a pesticide to birds. The preferred test species is either mallard duck or bobwhite quail. Results of this test are tabulated below. Acute oral testing was also performed with the formulation of methidathion . These test results are tabulated below.

Table . Avian Acute Oral Toxicity of Methidathion

Species	% ai	LD50 (mg/kg)	Toxicity Category	MRID No. Author/Year	Study Classification
Mallard (*Anas platyrhynchos)*	93.8	28	highly toxic	00157347 Beavers/1979	core
Mallard *(Anas platyrhynchos)*	98.2	23.6	highly toxic	0230346 Tucker/1969	supplemental
Ring-necked Pheasant *(Phasianus colchicus)*	98.2	33.2	highly toxic	0230346 Tucker/1969	supplemental
Chukar *(Alectoris chukar)*	98.2	225	moderately toxic	0230346 Tucker/1969	supplemental
Canada goose *(Branta canadensis)*	98.2	8.4	very highly toxic	00160000 Hudson/1984	supplemental

Table . Avian Acute Oral Toxicity of Methidathion					
Species	% ai	LD50 (mg/kg)	Toxicity Category	MRID No. Author/Year	Study Classification
Mallard *(Anas platyrhynchos)*	technical	6.7	very highly toxic	00230346 Fink/1976	supplemental

These results indicate that methidathion is moderately to very highly toxic to avian species on an acute oral basis. The guideline requirement (71-1) is fulfilled (MRID# 00157347).

Two subacute dietary studies using the technical grade of the active ingredient are required to establish the toxicity of a pesticide to birds. The preferred test species are mallard duck (a waterfowl) and bobwhite quail (an upland gamebird). Results of avian subacute dietary tests are tabulated below.

Table . Avian Subacute Dietary Toxicity of Methidathion					
Species	% ai	LC50 (ppm)	Toxicity Category	MRID No. Author/Year	Study Classification
Mallard duck *(Anas platyrhynchos)*	93.8	543	moderately toxic	00159201 Beavers/1979	core
Bobwhite quail (*Colinus virginianus)*	93.8	224	highly toxic	420817-01 Beavers/1979	core
Mallard duck *(Anas platyrhynchos)*	40	820 ppm product (328 ppm ai)	moderately toxic for formulation	0011841 Beliles/1965	supplemental
Northern bobwhite quail *(Colinus virginianus)*	40	600 ppm product (240 ppm ai)	moderately toxic for formulation	0011841 Beliles/1965	supplemental

These results indicate that methidathion is highly to moderately toxic to avian species on a subacute dietary basis. The guideline requirement (71-2) is fulfilled (MRID # 00159201, 42081701).

ii. Birds, Chronic

Avian reproduction studies using the technical grade of the active ingredient are required because Methidathion can be applied repeatedly to certain crops, and mammalian reproduction studies indicate the potential for effects at methidathion concentrations as low as 32 ppm. The preferred test species are mallard duck and bobwhite quail. Results of these tests are tabulated below.

Table . Avian Reproductive Toxicity of Methidathion					
Species	% ai	NOEC/LOEC (ppm)	Endpoints Affected	MRID No. Author/Year	Study Classification
Mallard duck *(Anas platyrhynchos)*	93.8	NOAEC: 1 LOAEC: 10	cracked eggs; hatchling numbers; 14-day survivor numbers; adult feed consumption	44381602 Beavers/1980	core

The mallard study showed a statistically significant increase in cracked eggs as a percentage of eggs laid at 10 ppm, and statistically significant reductions in: number of normal hatchlings as a percentage of live 3-week embryos (30 ppm), number of 14-day survivors as a percentage of eggs set (30 ppm), and adult feed consumption during week 2 of the study (30 ppm).

The guideline requirement for avian reproduction testing (71-4) is partially fulfilled (MRID # 443816-02). Reproduction testing with the northern bobwhite (or other acceptable upland gamebird species) needs to be repeated to completely fulfill Guideline 71-4. The value of the study is medium because on the one hand, the bobwhite is more sensitive, acutely, than the mallard. On the other hand, high chronic risk has already been concluded based on the mallard study. Obtaining an additional study might increase the magnitude of the risk quotients, but will not change the risk conclusions.

iii. Mammals, Acute and Chronic

Wild mammal testing is required on a case-by-case basis, depending on the results of lower tier laboratory mammalian studies, intended use pattern and pertinent environmental fate characteristics. In most cases, rat or mouse toxicity values obtained from the Agency's Health Effects Division (HED) substitute for wild mammal testing. These toxicity values are reported in the Table below.

Table . Mammalian Acute Toxicity of Methidathion				
Species	% ai	Test Type	Toxicity Values/category	MRID No.
Laboratory mouse *(Mus musculus)*	tech	acute oral LD50	17 mg/kg very highly toxic	000127-14
Laboratory rat *(Rattus norvegicus)*	tech	acute oral LD50	28 mg/kg (adult male) 12 mg/kg (weanling) very highly toxic	000127-14

Test results indicate that methidathion is very highly toxic (Category I) to small mammals on an acute oral basis.

Table . Mammalian Chronic Toxicity of Methidathion				
Species	% ai	Test Type	Toxicity Values/category	MRID No.
Laboratory rat *(Rattus norvegicus)*	tech	3-generation reproduction	Repro NOAEL=4 ppm, LEL=32 ppm	00011840
Laboratory rat *(Rattus norvegicus)*	tech	2-generation reproduction	Repro and systemic NOAEL=5 ppm, LEL 25 ppm	400798-12 400798-13

The 3-generation rat reproduction study provided a reproductive NOAEL of 4 ppm, based on offspring mortality. The 2-generation rat reproduction study provided a reproductive NOAEL of 5 ppm based on a decreased mating index and decreased pup weight and increased pup hypothermia. The systemic NOAEL for the 2-generation study was also 5 ppm, based on tremors and decreased food consumption during lactation and a transient decrease in body weight in both males and females.

iv. Insects

A honey bee acute contact study using the technical grade of the active ingredient is required for methidathion because its use may result in honey bee exposure. Results of this test are tabulated below.

Table . Nontarget Insect Acute Contact Toxicity of Methidathion					
Species	% ai	LD50 (μg/bee)	Toxicity Category	MRID No. Author/Year	Study Classification
Honey bee *(Apis mellifera)*	technical	0.236	very highly toxic	0036935 1975	core

The results indicate that methidathion is very highly toxic to bees on an acute contact basis. The guideline requirement (141-1) is fulfilled (ACC #0036935).

A honey bee toxicity of residues on foliage study using the typical end-use product is required for methidathion due to its very high actue toxicity. The results of this study are tabulated below.

Table . Nontarget Insect Toxicity of Methidathion Residues on Foliage				
Species	Formulatio n	Toxicity (Lb /A)	MRID # Author/year	Guideline Classification
Honey bee *(Apis mellifera*	2E (25.2%)	5 lb ai/A	420817-08 Hoxter/1991	core

The results indicate that methidathion residues on foliage are toxic to honey bees at application rates of 5.0 lb /A and greater. Guideline 141-2 is fulfilled (MRID #42081708).

v. Terrestrial Field Testing

Terrestrial field testing was not conducted for methidathion.

B. Toxicity to Freshwater Aquatic Animals

i. Freshwater Fish, Acute

Two freshwater fish toxicity studies using the technical grade of the active ingredient are required to establish the toxicity of a pesticide to fish. The preferred test species are rainbow trout (a coldwater fish) and bluegill sunfish (a warmwater fish). Results of these tests are tabulated below.

Table . Freshwater Fish Acute Toxicity of Methidathion

Species	% ai	LC50 (ppb ai)	Toxicity Category	MRID No. Author/Year	Study Classification
Rainbow trout *(Oncorhynchus mykiss)*	98.5	14	very highly toxic	40098001 F.L. Mayer/1986	core
	97.7	10	very highly toxic	00011841 /1965	supplemental
	2E (25.2%)	26.2 ppb product (6.6 ppb ai)	very highly toxic	42081703 /1991	core[1]
Bluegill sunfish *(Lepomis macrochirus*	98.5	9	very highly toxic	40098001 F.L. Mayer/1986	core
	95	2.2	very highly toxic	00011841 1965	supplemental
	2E (25.2%)	32.5 ppb product (8.2 ppb ai)	very highly toxic	42081702 /1991	core[1]
Goldfish (*Carassius auratus*)	97.7	6.8	very highly toxic	00011841 /1965	supplemental

[1] Formulation testing is required when a product is expected to reach surface water directly such as through direct application or drift.

These results indicate that methidathion is very highly toxic to freshwater fish on an acute basis. The guideline requirement (72-1) is fulfilled (40098001).

ii. Freshwater Fish, Chronic

Freshwater fish early life-stage testing was required for methidathion due to the likelihood of runoff from the application sites, the likelihood of repeated or continuous exposure from multiple applications, and the high acute toxicity to several species of freshwater fish. The preferred test species is rainbow trout, but other species may be used. Results of this test are tabulated below.

Table . Freshwater Fish Early Life-Stage Toxicity of Methidathion					
Species	% ai	NOAEC/LOAEC (ppb ai)	Endpoints Affected	MRID No. Author/Year	Study Classification
Fathead minnow *(Pimphales promelas)*	99.2	6.1/12.0	post-hatch survival; growth	00015735 /1984	supplemental

The guideline requirement (72-4a) is partially fulfilled (MRID# 00015735). Additional information was requested from the registrants in 1987, in order to upgrade the fish early life study to core status. There is no record of this information ever being received. This information, or repeated testing, is required to fulfill Guideline 72-4a.

A freshwater fish life-cycle (72-5) test using the technical grade of the active ingredient is required for methidathion because multiple applications are likely to result in long-term exposure, and because aquatic EECs exceed 0.1 of the NOAEC from the fish early life stage test. These data are required to fulfill Guideline 72-5. The value of this testing is medium, in that high chronic risk is already concluded for fish.

iii. Freshwater Invertebrates, Acute

A freshwater aquatic invertebrate toxicity test using the technical grade of the active ingredient is required to establish the toxicity of a pesticide to invertebrates. The preferred test species is *Daphnia magna*. Results of this test are tabulated below.

Table . Freshwater Invertebrate Toxicity of Methidathion					
Species	% ai	LC50/ EC50 (ppb ai)	Toxicity Category	MRID No. Author/Year	Study Classification
Waterflea *(Daphnia magna)*	tech	6.4	very highly toxic	00011350 1976	core
	2E (25.5%)	11.9 ppb product (3.0 ppb ai)	very highly toxic	42081704 1991	core

The results indicate that methidathion is very highly toxic to aquatic invertebrates on an acute basis. The guideline requirement (72-2) is fulfilled (ACC#00011350).

iv. Freshwater Invertebrate, Chronic

Freshwater aquatic invertebrate life-cycle testing was required for methidathion due to the likelihood of runoff from the application sites, the likelihood of repeated or continuous exposure from multiple applications, and the high acute toxicity to freshwater invertebrates. The preferred test species is *Daphnia magna*. Results of this test are tabulated below.

Table . Freshwater Aquatic Invertebrate Life-Cycle Toxicity of Methidathion

Species	% ai	NOAEC/ LOAEC (ppb)	Endpoints Affected	MRID No. Author/Year	Study Classification
Waterflea *(Daphnia magna)*	96.1	0.66/1.13	survival; # young/female/repro. day	42081707 Putt/1991	core

The guideline requirement (72-4b) is fulfilled (MRID #42081707).

v. Freshwater Field Studies

No freshwater field studies were reviewed for methidathion.

C. Toxicity to Estuarine and Marine Animals

i. Estuarine and Marine Fish, Acute

Acute toxicity testing with estuarine/marine fish using the technical grade of the active ingredient is required for methidathion because it is applied to crops such as cotton that may be grown near estuarine or marine habitat. The preferred test species is sheepshead minnow. Marine/estuarine acute testing was required for methidathion due to its use on crops grown in coastal areas. Results of these tests are tabulated below.

Table . Acute Toxicity of Methidathion to Estuarine/Marine Fish

Species	% ai	LC50 (ppb)	Toxicity Category	MRID No. Author/Year	Study Classification
Sheepshead minnow *(Cyprinodon variegatus)*	97.2	7.8	very highly toxic	00157350 /1981	core
	25.2	111.9 ppb product (28.3 ppb ai)	very highly toxic	42081705 /1991	core
	25.2	95 ppb product (24 ppb ai)	very highly toxic	43738501 /1995	core
Spot (*Leiostomus xanthrus)*	98.5	32	very highly toxic	40228101 Mayer/1986	core

The results indicate that methidathion is very highly toxic to estuarine/marine fish on an acute basis. The guideline requirement (72-3a) is fulfilled (MRID #00157350).

ii. Estuarine and Marine Fish, Chronic

Estuarine/marine fish early life-stage testing using the technical grade of the active ingredient is required for methidathion because it is applied to crops such as cotton that may be grown near estuarine or marine habitat, it is very high acute toxicity to estuarine/marine fish, because of the likelihood that methidathion will runoff or drift from the application sites and the repeated or continuous exposure from multiple applications. This testing has not been submitted; guideline 72-4a (marine/estuarine) is not fulfilled; however, since freshwater fish are comparably sensitive to methidathion, an acceptable freshwater fish early life-stage study would satisfy the guideline.

iii. Estuarine and Marine Invertebrates, Acute

Acute toxicity testing with estuarine/marine invertebrates using the technical grade of the active ingredient is required for methidathion because it is applied to crops such as cotton that may be grown near estuarine or marine habitat. The preferred test species are mysid shrimp and eastern oyster. Estuarine/marine invertebrate testing was required for methidathion due to its application to crops grown in coastal counties. Results of these tests are tabulated below.

Table : Acute Toxicity of Methidathion to Estuarine/Marine Invertebrates

Species	% ai.	96-hour LC50/EC50 (ppb)	Toxicity Category	MRID No. Author/Year	Study Classification
Eastern oyster--spat *(Crassostrea virginica)*	98.5	1000	highly toxic	40228401 Mayer/1986	core
larvae	100	7.9 (48 hour)	very highly toxic	40079815 /1986	supplemental
spat	95	7500	moderately toxic	42185201 /1991	core
spat	25.2	3600 ppb product (900 ppb ai)	highly toxic	42185202 /1991	core
Mysid (*Mysidopsis bahia*)	97.2	0.7	very highly toxic	00157350 /1981	core
	25.2	2.34 ppb product (0.59 ppb ai)	very highly toxic	42207902 /1991	core
Pink shrimp (*Penaeus duorarum*)	98.5	15 (48 hr)	very highly toxic	40228401 Mayer/1986	supplemental

The results indicate that methidathion is moderately to very highly toxic to estuarine/marine invertebrates on an acute basis. The guideline requirements (72-3b and 72-3c) are fulfilled (MRID #42185201 and 00157350, respectively).

iv. Estuarine and Marine Invertebrate, Chronic

Estuarine/marine invertebrate testing was required for methidathion due to its high acute toxicity to estuarine/marine organisms, the greater acute sensitivity of marine/estuarine organisms compared to freshwater organisms, and because methidathion is registered for crops such as cotton that are grown near estuarine or marine habitat and can be applied multiple times per season. The results of this test are tabulated below.

Table : Life-Cycle Toxicity of Methidathion to Estuarine/Marine Invertebrates

Species	% ai	NOEC/ LOEC (ppb)	Parameters Affected	MRID # Author/Year	Classification
Mysid (*Mysidopsis bahia*)	tech (14-C)	0.022/0.061	adult survival;	157351 1985	supplemental

The survival of parental mysids was adversely affected at levels of 0.061 ppb and higher. Additional data was requested from the registrant in 1987 in order to upgrade this study to core status. This information has not been received to date. Guideline 72-4b (marine/estuarine) is not fulfilled.

v. Estuarine and Marine Field Studies

No estuarine or marine field study data is available for methidathion.

D. Toxicity to Plants

i. Terrestrial

Currently, terrestrial plant testing is not required for pesticides other than herbicides except on a case-by-case basis (e.g., labeling bears phytotoxicity warnings, incidents of plant damage have been reported, or literature indicating phytotoxicity is available). Terrestrial plant testing is not required for methidathion.

ii. Aquatic Plants

Aquatic plant testing is not required for pesticides other than herbicides except on a case-by-case basis (e.g., labeling bears phytotoxicity warnings, incidents have been reported involving plants, or literature is available that indicates phytotoxicity). Aquatic plant testing is not required for methidathion.

V. Ecological Risk Assessment

Risk assessment integrates the results of the exposure and ecotoxicity data to evaluate the likelihood of adverse ecological effects. One method of integrating the results of exposure and ecotoxicity data is called the quotient method. For this method, risk quotients (RQs) are calculated by dividing exposure estimates by ecotoxicity values, both acute and chronic.

RQ = EXPOSURE/TOXICITY

RQs are then compared to OPP's levels of concern (LOCs). These LOCs are criteria used by OPP to indicate potential risk to nontarget organisms and the need to consider regulatory action. The criteria indicate that a pesticide used as directed has the potential to cause adverse effects on nontarget organisms. LOCs currently address the following risk presumption categories: (1) **acute high** - potential for acute risk is high regulatory action may be warranted in addition to restricted use classification (2) **acute restricted use** - the potential for acute risk is high, but this may be mitigated through restricted use classification (3) **acute endangered species** - the potential for acute risk to endangered species is high regulatory action may be warranted, and (4) **chronic risk** - the potential for chronic risk is high regulatory action may be warranted. Currently, EFED does not perform assessments for chronic risk to plants, acute or chronic risks to nontarget insects, or chronic risk from granular/bait formulations to mammalian or avian species.

The ecotoxicity test values (i.e., measurement endpoints) used in the acute and chronic risk quotients are derived from the results of required studies. Examples of ecotoxicity values derived from the results of short-term laboratory studies that assess acute effects are: (1) LC50 (fish and birds) (2) LD50 (birds and mammals (3) EC50 (aquatic plants and aquatic invertebrates) and (4) EC25 (terrestrial plants). Examples of toxicity test effect levels derived from the results of long-term laboratory studies that assess chronic effects are: (1) LOEC (birds, fish, and aquatic invertebrates) (2) NOEC (birds, fish and aquatic invertebrates) and (3) MATC (fish and aquatic invertebrates). For birds and mammals, the NOEC value is used as the ecotoxicity test value in assessing chronic effects. Other values may be used when justified. Generally, the MATC (defined as the geometric mean of the NOEC and LOEC) is used as the ecotoxicity test value in assessing chronic effects to fish and aquatic invertebrates. However, the NOEC is used if the measurement end point is production of offspring or survival.

Risk presumptions, along with the corresponding RQs and LOCs are tabulated below.

Risk Presumptions for Terrestrial Animals

Risk Presumption	RQ	LOC
Birds and Wild Mammals		
Acute High Risk	EEC[1]/LC50 or LD50/sqft[2] or LD50/day[3]	0.5
Acute Restricted Use	EEC/LC50 or LD50/sqft or LD50/day (or LD50 < 50 mg/kg)	0.2
Acute Endangered Species	EEC/LC50 or LD50/sqft or LD50/day	0.1
Chronic Risk	EEC/NOEC	1

[1] abbreviation for Estimated Environmental Concentration (ppm) on avian/mammalian food items

[2] $\frac{\text{mg/ft}^2}{\text{LD50 * wt. of bird}}$ [3] $\frac{\text{mg of toxicant consumed/day}}{\text{LD50 * wt. of bird}}$

Risk Presumptions for Aquatic Animals

Risk Presumption	RQ	LOC
Acute High Risk	EEC[1]/LC50 or EC50	0.5
Acute Restricted Use	EEC/LC50 or EC50	0.1
Acute Endangered Species	EEC/LC50 or EC50	0.05
Chronic Risk	EEC/MATC or NOEC	1

[1] EEC = (ppm or ppb) in water

Risk Presumptions for Plants

Risk Presumption	RQ	LOC
Terrestrial and Semi-Aquatic Plants		
Acute High Risk	EEC[1]/EC25	1
Acute Endangered Species	EEC/EC05 or NOEC	1
Aquatic Plants		
Acute High Risk	EEC[2]/EC50	1
Acute Endangered Species	EEC/EC05 or NOEC	1

[1] EEC = lbs ai/A
[2] EEC = (ppb/ppm) in water

A. Risk to Nontarget Terrestrial Animals

i. Birds

The acute risk quotients for broadcast applications of nongranular products are tabulated below.

Table . Avian Acute Risk Quotients for Single Application of Methidathion Based on a Bobwhite LC50 of 224 ppm .

Site/App. Method	App. Rate (lbs ai/A)	Food Items	Maximum EEC (ppm)	LC50 (ppm)	Acute RQ (EEC/ LC50)
MAXIMUM for: Pome fruits Stone fruits Olives Almonds	3	Short grass	720	224	3.21 a
		Tall grass	330	224	1.47 a
		Forage/ Insects	405	224	1.81 a
		Seeds	45	224	0.20 b
TYPICAL for: Citrus	2	Short grass	480	224	2.14 a
		Tall grass	220	224	0.98 a
		Forage/ Insects	270	224	1.20 a
		Seeds	30	224	0.13c
TYPICAL for: Walnuts Pome fruits Stone fruits Olives Almonds	1.5	Short grass	360	224	1.61 a
		Tall grass	165	224	0.74 a
		Forage/ Insects	203	224	0.91 a
		Seeds	23	224	0.10
MAXIMUM for: Safflower	0.5	Short grass	120	224	0.54 a
		Tall grass	55	224	0.24 b
		Forage/ insects	67.5	224	0.30 b
		Seeds	7.5	224	0.03

a exceeds acute high, acute restricted and acute endangered species LOCs.
b exceeds acute restricted and acute endangered species LOCs.
c exceeds acute endangered species LOC

An analysis of the results indicates that for a single application of nongranular products, avian acute high, restricted use, and endangered species levels of concern are exceeded at registered application rates equal to or above 0.5 lb ai/A.

The chronic risk quotients for a single application of nongranular methidathion are tabulated below.

Table . Avian Chronic Risk Quotients for Single Applications of Methidathion Based on a Mallard NOAEC of 1 ppm. A foliar dissipation halflife of 11.3 days was assumed. Time period modeled: 30 days.

Site/ App. Method	App Rate (lbs ai/A)	Food Items	Peak Mean EEC (ppm)	Time wgt Avg- Mean EEC (ppm)	Chronic RQ: Peak Mean EEC/ NOAEC	Chronic RQ: Avg Mean EEC/ NOAEC	Number days LOC exceeded
Pome fruits, stone fruits, olives, almonds (max)	3	Short grass	255	20	255 a	20 a	23
		Tall grass	108	8	108 a	8 a	20
		Forage	135	11	135 a	11 a	21
		Seeds	21	2	21 a	2 a	13
Citrus (typ)	2	Short grass	170	14	170 a	14 a	22
		Tall grass	72	6	72 a	6 a	19
		Forage	90	7	90 a	7 a	19
		Seeds	14	1	14 a	1 a	11
Walnuts, pome fruits, stone fruits, olives, almonds (typ)	1.5	Short grass	128	10	128 a	10 a	21
		Tall grass	54	4	54 a	4 a	17
		Forage/ Insects	68	5	68 a	5 a	18
		Seeds	10	0.8	10 a	0.8	8
Safflower (max)	0.5	Short grass	42.5	3	42.5 a	3 a	26
		Tall grass	18.0	1	18.0 a	1 a	12
		Forage/ Insects	22.5	2	22.5 a	2 a	13
		Seeds	3.5	<1	3.5 a	<1	4

a= chronic LOC has been exceeded

An analysis of the results indicate that for a single application of nongranular methidathion, the avian chronic level of concern is exceeded at application rates equal to or above 0.5lb ai/A.

The acute risk quotients for multiple applications of nongranular products of methidathion are tabulated below. Maximum EECs result from the pesticide being applied repeatedly, but degrading over the course of time from the first application to the last application (FATE program).

Table . Avian Acute Risk Quotients for Multiple Applications of Methidathion Based on a Bobwhite LC50 of 224 ppm.

Site/App. Method	App. Rate (lbs ai/A) (No. of Apps.)/Appl interval	Food Items	Maximum EEC[1] (ppm)	LC50 (ppm)	Acute RQ (EEC/ LC50)
Artichoke (max)	1 (8)/14	Short grass	433	224	1.9 a
		Tall grass	191	224	0.8 a
		Forage/Insects	234	224	1.0 a
		Seeds	26	224	0.1 c
Artichoke (typ)	1 (2)/14	Short grass	342	224	1.5 a
		Tall grass	157	224	0.7 a
		Forage/Insects	192	224	0.8 a
		Seeds	21	224	0.1 c
Citrus (max)	5 (2)/45	Short grass	1276	224	5.7 a
		Tall grass	585	224	2.6 a
		Forage/Insects	718	224	3.2 a
		Seeds	80	224	0.4 b
Cotton (max)	1 (16)/5	Short grass	902	224	4.0 a
		Tall grass	413	224	1.8 a
		Forage/Insects	507	224	2.3 a
		Seeds	56	224	0.2 b
Cotton (typ)	0.5 (2)/5	Short grass	208	224	0.9 a
		Tall grass	95	224	0.4 b
		Forage/Insects	117	224	0.5 a
		Seeds	13	224	0.0
Walnuts (max)	3 (3)/7 days	Short grass	1493	224	6.7 a
		Tall grass	685	224	3.0 a
		Forage/Insects	840	224	3.8 a
		Seeds	93	224	0.4 b
Safflower (max)	0.5 (3)/7	Short grass	249	224	1.1 a
		Tall grass	114	224	0.5 a
		Forage/Insects	140	224	0.6 a
		Seeds	16	224	0.1 c

1 Assumes degradation using FATE program using a half-life of 11.3 days

a Exceeds acute high risk, restricted use and endangered species LOCs

b Exceeds acute restricted use and endangered species LOCs c Exceeds acute endangered species LOC

The results indicate that for multiple applications of nongranular products, maximum residues on all items except seeds will usually exceed the high acute risk, restricted use, and endangered species LOCs for application rates at or above 0.5 ai/A. Maximum residues on seeds will exceed the endangered species LOCs at application rates at or above 0.5 ai/A.

The chronic risk quotients for multiple applications of nongranular products of methidathion are tabulated below. Chronic risk EECs are based on the mean values from Fletcher et al.(1994). Peak mean EECs result from the pesticide being applied repeatedly, but degrading over the course of time from the first application to the last application (FATE program). The estimated daily concentrations from the FATE program were used to estimate the time weighted average over a period of time and were also derived.

Table . Avian Chronic Risk Quotients for Multiple Applications of Methidathion Based on a Mallard NOAEC of 1 ppm. A foliar dissipation halflife of 11.3 days was assumed.

Site/App Method	App. Rate, # Apps, App. interval	Food Items	Peak Mean EEC[1] (ppm)	Time Wgt Avg Mean EEC[1] (ppm)	NOAEC (ppm)	Chronic RQ: Peak Mean EEC/ NOAEC	Chronic RQ: Avg Mean EEC/ NOAEC	# days EEC ≥ NOAEC
Artichoke (max)	8 apps. at 1 lb ai/A, 14-d app. interval	Short grass	147.3	79.8	1	147.3 a	79.8 a	140+
		Tall grass	62.4	33.8	1	62.4 a	33.8 a	140 +
		Forage/ Insects	78.0	42.2	1	78.0 a	42.2 a	140 +
		Seeds	12.1	6.6	1	12.1 a	6.6 a	140 +
Artichoke (typical)	2 apps. at 1 lb ai/A, 14-d app. interval	Short grass	121.0	45.0	1	121.0 a	45.0 a	60 +
		Tall grass	51.2	19.0	1	51.2 a	19.0 a	60 +
		Forage/ Insects	64.1	23.8	1	64.1 a	23.8 a	60 +
		Seeds	10.0	3.7	1	10.0 a	3.7 a	51
Citrus (max)	2 apps. at 5 lb aiA, 45-day app. interval	Short grass	451.9	152.0	1	451.9 a	152.1 a	90 +
		Tall grass	191.4	64.4	1	191.4 a	64.4 a	90 +
		Forage/ Insects	239.2	80.5	1	239.2 a	80.5 a	90 +
		Seeds	37.2	12.5	1	37.2 a	12.5 a	90 +
Cotton (max)	16 apps at 1 lb ai/A,5-d app. interval	Short grass	319.4	29.1	1	319.4 a	29.1 a	90 +
		Tall grass	135.3	97.0	1	135.3 a	97.0 a	90 +
		Forage/ Insects	169.1	121.3	1	169.1 a	121.3 a	90 +
		Seeds	26.3	18.9	1	26.3 a	18.9 a	90 +

Table . Avian Chronic Risk Quotients for Multiple Applications of Methidathion Based on a Mallard NOAEC of 1 ppm. A foliar dissipation halflife of 11.3 days was assumed.								
Site/App Method	App. Rate, # Apps, App. interval	Food Items	Peak Mean EEC[1] (ppm)	Time Wgt Avg Mean EEC[1] (ppm)	NOAEC (ppm)	Chronic RQ: Peak Mean EEC/ NOAEC	Chronic RQ: Avg Mean EEC/ NOAEC	# days EEC ≥ NOAEC
Cotton (typ)	2 apps at 0.5 lb ai/A, 5-d app. interval	Short grass	73.8	15.6	1	73.8 a	15.6 a	75
		Tall grass	31.2	6.6	1	31.2 a	6.6 a	61
		Forage/ insects	39.0	8.3	1	39.0 a	8.3 a	64
		Seeds	6.1	1.3	1	6.1 a	1.3 a	64
Walnuts (max)	3 apps. at 3 lb ai/A, 7-d app. interval	Short grass	529.0	313.7	1	529.0 a	313.7 a	30 +
		Tall grass	224.0	132.8	1	224.0 a	132.8 a	30 +
		Forage/ Insects	280.1	166.1	1	280.1 a	166.1 a	30 +
		Seeds	43.6	25.8	1	43.6 a	25.8 a	30 +
Safflower (max)	3 apps. at 0.5 lb ai/A, 7-d app. interval	Short grass	88.2	52.3	1	88.2 a	52.3 a	30 +
		Tall grass	37.3	22.1	1	37.3 a	22.1 a	30 +
		Forage/ insects	46.7	27.7	1	46.7 a	27.7 a	30 +
		Seeds	7.3	4.3	1	7.3 a	4.3 a	30 +

1 Assumes degradation using FATE program, using a half-life of 11.3 days.
a=chronic high-risk LOC has been exceeded.

Based on both the peak and teim weighted average mean EECs, and taking into account foliar dissipation, the avian chronic level of concern is exceeded by residues on all food items for all labeled uses.

ii. Mammals

a. Acute risk

Estimating the potential for adverse effects to wild mammals is based upon EEB's draft 1995 SOP of mammalian risk assessments and methods used by Hoerger and Kenaga (1972) as modified by Fletcher *et al.* (1994). The concentration of methidathion in the diet that is expected to be acutely lethal to 50% of the test population (LC50) is determined by dividing the LD50 value (usually rat LD50) by the percent of body weight consumed. A risk quotient is then determined by dividing the EEC by the derived LC50 value. Risk quotients are calculated for three separate weight classes of mammals (15, 35, and 1000 g), each presumed to consume four different kinds of food (grass, forage, insects, and seeds). The acute risk quotients for broadcast applications of nongranular products are tabulated below:

Table . Mammalian (Herbivore/Insectivore) Acute Risk Quotients for Single Application of Methidathion Based on a Rat LD50 of 12 mg/Kg.

Site	Appl. rate, (lb ai/A)	Body Wt (g)	% Body Wt Cons	EEC Short Grass	EEC Forage & Small Insects	EEC Large Insects	Acute RQ Short Grass	Acute RQ Forage & Small Insects	Acute RQ Large Insects
Pome fruits, stone fruits, tree nuts (max)	3	15	95	720	405	45	57.0 a	32.1 a	3.6 a
		35	66	720	405	45	39.6 a	22.3 a	2.5 a
		1000	15	720	405	45	9.0 a	5.1 a	0.6 a
Citrus (typ)	2	15	95	480	270	39	38.0 a	21.4 a	3.1 a
		35	66	480	270	39	21.4 a	14.8 a	2.1 a
		1000	15	480	270	39	6.0 a	2.4 a	0.5 a
Walnuts, pome fruits, stone fruits, nuts (typ)	1.5	15	95	360	202	22	28.5 a	16.0 a	1.7 a
		35	66	360	202	22	19.8 a	11.1 a	1.2 a
		1000	15	360	202	22	4.5 a	2.5 a	0.3 b
Safflower (max)	0.5	15	95	249	140	16	19.7 a	11.1 a	1.3 a
		35	66	249	140	16	13.7 a	7.7 a	0.9 a
		1000	15	249	140	16	3.1 a	1.8 a	0.2 b

[1] RQ = $\frac{\text{EEC (mg/kg)}}{\text{LD50 (mg/kg)/ \% Body Weight Consumed}}$

a=high risk, restricted use and endangered species LOCs have been exceeded

For all single applications at rates greater than 2 lb ai/A, high-risk acute RQs for all size classes of herbivorous/insectivorous mammals consuming grasses, forage, and insects exceed the LOC for presumption of high acute risk, the LOC for restricted use, and the LOC for presumption of risk to endangered species. The LOCs for high risk are exceeded for smaller mammals eating grasses, forage and insects by application rates greater than or equal to 0.5 lb ai/a. LOCs for restricted use and endangered species are also exceeded for large mammals (1000g body weight) consuming large insects in areas where methidathion is applied at greater than or equal to 0.5 lb ai/A. For citrus, at the typical application rate, high acute risk is presumed. At that maximum rate, higher risk would be assumed.

Table . Mammalian (Granivore) Acute Risk Quotients for Single Application of Methidathion Based on a rat LD50 of 12 mg/kg.

Site	Application Rate in lbs ai/A	Body Weight (g)	% Body Weight Consumed	Rat LD50 (mg/kg)	EEC Seeds	Acute RQ Seeds
Pome fruits, stone fruits, olives, almonds (max)	3	15	21	12	45	0.8 a
		35	15	12	45	0.6 a
		1000	3	12	45	0.1 c
Citrus (typ)	2	15	21	12	39	0.7 a
		35	15	12	39	0.5 a
		1000	3	12	39	0.1 c
Walnuts, pome fruits, stone fruits, olives, almonds (typ)	1.5	15	21	12	22	0.4 b
		35	15	12	22	0.3 b
		1000	3	12	22	0.0
Safflower (max)	0.5	15	21	12	16	0.3 b
		35	15	12	16	0.2 b
		1000	3	12	16	0.0

[1] RQ = $\frac{\text{EEC (mg/kg)}}{\text{LD50 (mg/kg)/ \% Body Weight Consumed}}$

a=high risk, restricted use and endangered species LOCs have been exceeded
b=restricted use and endangered species LOCs have been exceeded
c=endangered species LOCs have been exceeded

For smaller granivores, the high risk LOC is exceeded at application rates of 2 lb ai/A and greater. Restricted use and endangered species LOCs are also exceeded for large granivores at these application rates. Application rates of 0.5 lb ai/A and greater exceed the restricted use and endangered species LOCs for smaller granivores. For citrus, at the typical application rate, acute risk LOCs are exceeded by a small margin. At higher rates, higher risk would be assumed.

Table . Mammalian (Herbivore/Insectivore) Acute Risk Quotients for Multiple Applications of Methidathion Based on a rat LD50 of 12 mg/kg. A foliar dissipation halflife of 11.3 days was assumed.

Site/ App. Method/ lbs ai/A (No. of Apps.)	Body Weight (g)	% Body Weight Con-sumed	Rat LD50 mg/kg	EEC Short Grass	EEC Forage & Small Insects	EEC Large Insects	Acute RQ Short Grass	Acute RQ Forage & Small Insects	Acute RQ Large Insects
Artichokes (max) 1 (8)	15	95	12	433	234	26	34.3 a	18.5 a	2.0 a
	35	66	12	433	234	26	23.8 a	12.9 a	1.4 a
	1000	15	12	433	234	26	5.4 a	2.9 a	0.3 b
Artichokes (typ) 1 (2)	15	95	12	341	192	21	27.0 a	15.2 a	1.7 a
	35	66	12	341	192	21	18.0 a	10.6 a	1.2 a
	1000	15	12	341	192	12	4.3 a	2.4 a	0.3 b
Citrus (max) 5 (2)	15	95	12	1276	718	80	101.0 a	56.8 a	6.3 a
	35	66	12	1276	718	80	70.2 a	39.5 a	4.4 a
	1000	15	12	1276	718	80	16.0 a	9.0 a	1.0 a
Cotton (max) 1 (16)	15	95	12	902	507	56	71.4 a	40.1 a	4.4 a
	35	66	12	902	507	56	49.6 a	27.9 a	3.1 a
	1000	15	12	902	507	56	11.3 a	6.3 a	0.7 a
Cotton (typ) 0.5 (2)	15	95	12	208	117	13	16.5 a	9.3 a	1.0 a
	35	66	12	208	117	13	11.4 a	6.4 a	0.7 a
	1000	15	12	208	117	13	2.6 a	1.5 a	0.2 b
Walnut (max) 3 (3)	15	95	12	1493	840	93	118.2a	66.5 a	7.4 a
	35	66	12	1493	840	93	82.1 a	46.2 a	5.1 a
	1000	15	12	1493	840	93	18.7 a	10.5 a	1.2 a
Safflower (max) 0.5 (3)	15	95	12	249	140	16	19.7 a	11.1 a	1.2 a
	35	66	12	249	140	16	13.7 a	7.7 a	0.9 a
	1000	15	12	249	140	16	3.1 a	1.8 a	0.2 b

[1] RQ = $\frac{\text{EEC (mg/kg)}}{\text{LD50 (mg/kg)/ \% Body Weight Consumed}}$

a=high risk, restricted use and endangered species LOCs exceeded

b=restricted use and endangered species LOCs exceeded

Table . Mammalian (Granivore) Acute Risk Quotients for Multiple Applications of Methidathion Based on a rat LD50 of 12 mg/kg. A foliar dissipation halflife of 11.3 days was assumed.					
Site/ App. Rate in lbs ai/A (No. of Apps.)	Body Weight (g)	% Body Weight Consumed	Rat LD50 (mg/kg)	EEC Seeds	Acute RQ Seeds
Artichoke (max) 1 (8)	15	21	12	26	0.4 b
	35	15	12	26	0.3 b
	1000	3	12	26	0.1 c
Artichoke (typ) 1 (2)	15	21	12	21	0.4 b
	35	15	12	21	0.3 b
	1000	3	12	21	< 0.01
Citrus (max) 5 (2)	15	21	12	80	1.4 a
	35	15	12	80	1.0 a
	1000	3	12	80	0.2 b
Cotton (max) 1 (16)	15	21	12	56	1.0 a
	35	15	12	56	0.7 a
	1000	3	12	56	0.1 c
Cotton (typ) 0.5 (2)	15	21	12	13	0.2 b
	35	15	12	13	0.2 b
	1000	3	12	13	<0.01
Walnut (max) 3 (3)	15	21	12	93	1.6 a
	35	15	12	93	1.2 a
	1000	3	12	93	0.3 b
Safflower (max) 0.5 (3)	15	21	12	16	0.3 b
	35	15	12	16	0.2 b
	1000	3	12	16	< 0.01

[1] $RQ = \frac{\text{EEC (mg/kg)}}{\text{LD50 (mg/kg)/ \% Body Weight Consumed}}$

a=high risk, restricted use and endangered species LOCs have been exceeded
b=restricted use and endangered species LOCs have been exceeded
c=endangered species LOCs have been exceeded

All uses of methidathion exceed mammal acute risk LOCs (high risk, restricted use, endangered species) for herbivores and insectivores. A few uses such as artichokes and safflower do not exceed the high risk LOC, but do exceed the other LOCs (restricted use; endangered species.

b. Chronic Risk

The chronic risk quotients for broadcast applications are tabulated below. Chronic risk EECs are based on the mean values from Fletcher et al.(1994). Peak mean EECs result from the pesticide being applied repeatedly, but degrading over the course of time from the first application to the last application (FATE program). The estimated daily concentrations from the FATE program were used to estimate the time weighted average over a period of time and were also derived.

Table . Mammalian Chronic Risk Quotients for Single and Multiple Applications of Methidathion Based on a rat NOAEC of 5 ppm in a 2-generation reproduction study. A foliar dissipation halflife of 11.3 days was assumed.

Site	lbs ai/A (# Apps.)	Food Items	Peak Mean EEC[1] (ppm)	Time Wgt Avg Mean EEC[1] (ppm)	NOAEC (ppm)	Chronic RQ: Peak Mean EEC /NOAEC	Chronic RQ: Avg Mean EEC /NOAEC	# days EEC ≥ NOAEC
Artichoke (max)	1 (8)	Short grass	147.3	79.8	5	29.5 a	16.0 a	140 +
		Tall grass	62.4	33.8	5	12.5 a	6.8 a	138.00
		Forage /Insects	78.0	42.2	5	15.6 a	8.4 a	140 +
		Seeds	12.1	6.6	5	2.4 a	1.3 a	113.00
Artichoke (typ)	1 (2)	Short grass	121.0	45.0	5	24.2 a	9.0 a	60 +
		Tall grass	51.2	19.0	5	10.2 a	3.8 a	51
		Forage /Insects	64.1	23.8	5	12.8 a	4.8 a	55
		Seeds	10.0	3.7	5	2.0 a	0.7 a	17
Citrus (max)	5 (2)	Short grass	451.9	152.0	5	90.4 a	30.4 a	90 +
		Tall grass	191.4	64.4	5	38.3 a	12.9 a	90 +
		Forage plants/Insects	239.2	80.5	5	47.8 a	16.1 a	90 +
		Seeds	37.2	12.5	5	7.4 a	2.5 a	90+
Citrus (typ)	2 (1)	Short grass	170.0	31.3	5	34.0 a	6.3 a	57
		Tall grass	72.0	13.2	5	14.1 a	2.6 a	43
		Forage/ Insects	90.0	16.6	5	18.0 a	3.3 a	47
		Seeds	14.0	2.6	5	2.8 a	0.5 a	17

Table . Mammalian Chronic Risk Quotients for Single and Multiple Applications of Methidathion Based on a rat NOAEC of 5 ppm in a 2-generation reproduction study. A foliar dissipation halflife of 11.3 days was assumed.

Site	lbs ai/A (# Apps.)	Food Items	Peak Mean EEC[1] (ppm)	Time Wgt Avg Mean EEC[1] (ppm)	NOAEC (ppm)	Chronic RQ: Peak Mean EEC /NOAEC	Chronic RQ: Avg Mean EEC /NOAEC	# days EEC ≥ NOAEC
Cotton (max)	1 (16)	Short grass	319.4	229.1	5	63.9 a	45.8 a	90+
		Tall grass	135.3	97.0	5	27.1 a	19.4 a	90+
		Forage/ insects	169.1	121.3	5	33.8 a	24.3 a	90+
		Seeds	26.3	18.9	5	5.3 a	3.8 a	90+
Cotton (typ)	0.5 (2)	Short grass	73.8	15.6	5	14.8 a	3.1 a	48
		Tall grass	31.2	6.6	5	6.2 a	1.3 a	35
		Forage/ insects	39.0	8.3	5	7.8 a	1.7 a	38
		Seeds	6.1	1.3	5	1.2 a	0.3	3
Walnuts (max)	3 (3)	Short grass	529.0	313.7	5	105.8 a	62.7 a	30+
		Tall grass	22.40	132.8	5	44.8 a	26.6 a	30+
		Forage/ insects	280.1	166.1	5	56.0 a	33.2 a	30+
		Seeds	43.6	25.8	5	8.7 a	5.2 a	30+
Pome fruits, stone fruits, nuts (max)	3 (1)	Short grass	255.0	68.6	5	51.2 a	13.7 a	60+
		Tall grass	108.0	29.0	5	21.6 a	5.8 a	50
		Forage /insects	135.0	36.3	5	27.0 a	7.3 a	53
		Seeds	21.0	5.6	5	4.2 a	1.1 a	24
Walnuts, Pome fruits, stone fruits, nuts (typ)	1.5 (1)	Short grass	127.5	58.8	5	25.5 a	11.8 a	30+
		Tall grass	54.0	24.9	5	10.8 a	5.0 a	30+
		Forage/ insects	67.5	31.1	5	13.5 a	6.2 a	30+
		Seeds	1.8	0.8	5	0.4	0.2	0

Table . Mammalian Chronic Risk Quotients for Single and Multiple Applications of Methidathion Based on a rat NOAEC of 5 ppm in a 2-generation reproduction study. A foliar dissipation halflife of 11.3 days was assumed.								
Site	lbs ai/A (# Apps.)	Food Items	Peak Mean EEC[1] (ppm)	Time Wgt Avg Mean EEC[1] (ppm)	NOAEC (ppm)	Chronic RQ: Peak Mean EEC /NOAEC	Chronic RQ: Avg Mean EEC /NOAEC	# days EEC ≥ NOAEC
Safflower (max)	0.5 (3)	Short grass	88.2	52.3	5	17.6 a	10.5 a	30+
		Tall grass	37.3	22.1	5	7.5 a	4.4 a	30+
		Forage/ insects	46.7	27.7	5	9.3 a	5.5 a	30+
		Seeds	7.3	4.3	5	1.5 a	0.9	10
Safflower (typ)	0.5 (1)	Short grass	42.5	19.6	5	8.5 a	3.9 a	30+
		Tall grass	18.0	8.3	5	3.6 a	1.7 a	21
		Forage/ insects	22.5	10.4	5	4.5 a	2.1 a	24
		Seeds	3.5	1.6	5	0.7	0.3	0

a=high risk LOC has been exceeded

The above results indicate that for broadcast applications of nongranular products, the chronic level of concern for mammals is exceeded at registered application rates equal to or above 0.5 lbs ai/A.

iii. Insects

Currently, EFED does not assess risk to nontarget insects. Results of acceptable studies are used for recommending appropriate label precautions. Methidathion is classified as highly toxic to the honeybee on an acute contact and residual basis; therefore, appropriate toxicity label language is required. Current labeling includes the appropriate bee toxicity warning statement.

B. Risk to Nontarget Freshwater Aquatic Animals

Tier II estimated environmental concentrations (EECs) for three crop scenarios, representing a range of methidathion applications, were calculated to generate aquatic exposure estimates for use in the ecological risk assessment.

i. Freshwater Fish

Acute and chronic risk quotients are tabulated below.

Table . Methidathion Acute Risk Quotients for Freshwater Fish Based On a Bluegill Sunfish LC50 of 9 ppb (most sensitive species). EECs are from PRZM/EXAMS.			
Site/Typical application rate (# apps.), method of application	LC50 (ppb)	EEC Initial/Peak (ppb)	Acute RQ (EEC/LC50)
Apples/1.5 lb ai/A (1) airblast	2.2	8.48	3.8 a
Citrus/2.0 lb ai/A (1) airblast	2.2	26.51	12.0 a
Cotton/0.5 lb ai/A (2) aerial	2.2	12.24	5.5 a

a=high risk, restricted use and endangered species LOC s have been exceeded
b=restricted use and endangered species LOCs have been exceeded
c=endangered species LOC has been exceeded

Note that the LC50 used in this assessment is from a supplemental study (00011841). However, the next highest LC50 is 9 ppb (40098001). Risk quotients calculated from an LC50 of 9 ppb would also exceed the acute high risk LOC. The results indicate that the aquatic acute high risk level of concern is exceeded by multiple applications at rates greater than or equal to 0.5 lb ai/A, and single applications at rates greater than or equal to 1.5 lb ai/A .

Table . Chronic Risk Quotients for Freshwater Fish Based On a Fathead Minnow NOAEC of 6.1 ppb.			
Site/Typical Application Rate in lbs ai/A (No. of Apps.)	Fathead minnow NOAEC (ppb)	EEC 60-Day (ppb)	Chronic RQ Based on Fathead minnow NOAEC (EEC/NOAEC)
Apples--air blast, 1.5 (1)	6.1	4.11	0.67
Citrus --airblast 2.0 (1)	6.1	11.45	1.88 a
Cotton--aerial 0.5 (2)	6.1	5.56	0.91

a= high risk LOC has been exceeded

The results indicate that the aquatic chronic level of concern is exceeded for methidathion at application rates of greater than or equal to 2.0 lb ai/A.

ii. Freshwater Invertebrates

The acute and chronic risk quotients are tabulated below.

Table . Risk Quotients for Freshwater Invertebrates Based on a daphnia magna LC50 of 6.4 ppb and a life-cycle NOAEC Of 0.066 ppb.						
Site/Rate in lbs ai/A (No. of Apps.)	LC50 (ppb)	NOAEC (ppb)	EEC Initial/Peak (ppb)	EEC 21-Day (ppb)	Acute RQ (EEC/LC50)	Chronic RQ (EEC/NOAEC)
Apples, airblast, 1.5 (1)	6.4	0.066	8.48	6.37	1.3 a	96.5 a
Citrus-airblast, 2.0 (1)	6.4	0.066	26.51	18.87	4.1 a	285.9 a
Cotton--aerial 0.5 (2)	6.4	0.066	12.24	8.47	1.9 a	128.3 a

a=high risk, restricted use and endangered species LOCs have been exceeded
b=restricted use and endangered species LOCs have been exceeded
c=endangered species LOC has been exceeded

The results indicate that the aquatic acute high risk level of concern has been exceeded for freshwater invertebrates at application rates equal to or greater than 0.5 lb ai/A. The chronic level of concern has been greatly exceeded for application rates of equal to or greater than 0.5 lb ai/A.

C. Exposure and Risk to Nontarget Estuarine and Marine Animals

i. Fish

a. Acute

The acute risk quotients for estuarine and marine fish are tabulated below.

Table . Acute Risk Quotients for Marine/Estuarine Fish Based on a Sheepshead Minnow LC50 of 7.8 ppb.			
Site/Rate lbs ai/A (No. of Apps.)	LC50 (ppb)	EEC Initial/Peak (ppb)	Acute RQ (EEC/LC50)
Apples--air blast 1.5 (1)	7.8	8.48	1.1 a
Citrus--air blast 2.0 (1)	7.8	26.51	3.4 a
Cotton--aerial 0.5 (2)	7.8	12.24	1.6 a

a=high risk, restricted use and endangered species LOCs have been exceeded
b=restricted use and endangered species LOCs have been exceeded
c=endangered species LOC has been exceeded

The results indicate that the aquatic acute restricted use level of concern for marine/estuarine fish is exceeded by applications of 0.5 lb ai/A and greater.

b. Chronic

Chronic risk to marine/estuarine fish from methidathion cannot be assessed at this time due to a lack of acceptable early life-stage or life-cycle data. Since the acute toxicity of methidathion to freshwater fish (9 ppb) is similar to the toxicity to marine/estuarine fish (7.8 ppb), it is likely that the chronic toxicity would also be similar. For freshwater fish, multiple applications of methidathion at 0.5 lb ai/A and greater, and single applications of 2 lb ai/A and greater resulted in exceedance of the chronic LOC. Comparable or greater risk should be assumed for marine/estuarine species until acceptable data is received and a complete risk assessment can be performed.

ii. Invertebrates

The acute and chronic risk quotients for aquatic invertebrates are tabulated below.

Table . Acute Risk Quotients for Marine/Estuarine Invertebrates Based on a Mysid LC50 of 0.7 ppb.

Site/Rate lbs ai/A (# Apps)	LC50 (ppb)	EEC Initial/Peak (ppb)	Acute RQ (EEC/LC50)[1]
Apples 1.5 (1)	0.7	8.48	12.1 a
Citrus 2.0 (1)	0.7	26.51	37.9 a
Cotton 0.5 (2)	0.7	12.24	17.5 a

a=high risk, restricted use and endangered species LOCs have been exceeded
b=restricted use and endangered species LOCs have been exceeded
c=endangered species LOC has been exceeded

The results indicate that the aquatic acute high risk level of concern has been exceeded for marine/estuarine invertebrates for applications of 0.5 lb ai/A and greater

Table . Chronic Risk Quotients for Marine/Estuarine Invertebrates Based on a Mysid Life-Cycle NOAEC of 0.02 ppb.

Site/Rate lbs ai/A (#. of Apps.)	Early Life-Stage NOAEC (ppb)	EEC 21-Day (ppb)	Life-Cycle RQ (21-Day EEC/NOAEC)
Apples 1.5 (1)	0.02	6.37	318 a

Table . Chronic Risk Quotients for Marine/Estuarine Invertebrates Based on a Mysid Life-Cycle NOAEC of 0.02 ppb.			
Site/Rate lbs ai/A (#. of Apps.)	Early Life-Stage NOAEC (ppb)	EEC 21-Day (ppb)	Life-Cycle RQ (21-Day EEC/NOAEC)
Citrus 2.0 (1)	0.02	18.87	944 a
Cotton 0.5 (2)	0.02	8.47	424 a

a=high risk LOC has been exceeded

The results indicate that the chronic level of concern has been exceeded for marine/estuarine invertebrates for all application scenarios modeled, at rates greater than or equal to 0.5lb ai/A.

D. Exposure and Risk to Nontarget Plants

Terrestrial and aquatic plant testing is not required for methidathion; no nontarget plant risk assessment was performed.

VI. Endangered Species

All uses of methidathion exceed the endangered species LOC for all forms of endangered animal species.

The Agency has developed a program (the "Endangered Species Protection Program") to identify pesticides whose use may cause adverse impacts on endangered and threatened species, and to implement mitigation measures that will eliminate the adverse impacts. At present, the program is being implemented on an interim basis as described in a Federal Register notice (54 FR 27984-28008, July 3, 1989), and is providing information to pesticide users to help them protect these species on a voluntary basis. As currently planned, the final program will call for label modifications referring to required limitations on pesticide uses, typically as depicted in county-specific bulletins or by other site-specific mechanisms as specified by state partners. A final program, which may be altered from the interim program, will be described in a future Federal Register notice. The Agency is not imposing label modifications at this time through the RED. Rather, any requirements for product use modifications will occur in the future under the Endangered Species Protection Program.

The following endangered species LOCs have been exceeded for methidathion: avian acute, avian chronic, mammalian acute, mammalian chronic, freshwater fish acute, freshwater invertebrate acute, freshwater invertebrate chronic, marine/estuarine fish acute, marine/estuarine fish chronic, marine/estuarine invertebrate acute, and marine/estuarine invertebrate chronic.

VII. Methidathion Incident Reports

There are no bird or fish kills reported for methidathion. However, failure to detect and report field kills is not a strong indication that incidents are not occurring. Small dead animals often go unnoticed, and are quickly scavanged. Chronic effects, and mortality to invertebrates are not usually detectable by casual observation.

VIII. Risk Characterization

A. Characterization of the Use of Methidathion

Methidathion is used primarily in California (90-95%),with the remainder of the use in Florida, Arizona, Washington, New York, and Virginia. Special Local Needs exemptions are listed for timothy hay (non-fed) in Washington, alfalfa (non-fed) in California, and for certain fruit crops (kiwifruit, longan, carambola, mango, and sugar apple). The crop with the greatest methidathion-treated acreage is cotton (120,000 A), followed by tree nuts (65,000 A) and stone fruit (60,000 A). However, methidathion treatment occurs on only 0.2% of cotton, 3% of tree nuts, and 3% of stone fruit, compared to 25% of timothy hay crops (as a Section 24c), 20% of artichokes, and 19% of olives. A total of 459,000 lb a.i. are used per year (1996 Martiz data, taken from Quantitative Usage Information table provided by Novartis).

A further refinement of methidathion's potential for ecological risk is possible due to its predominant use in California. According to BEAD's usage information from 1991 thru 1994 and personal communication with Chris Foe (California Central Valley Regional Water Quality Control Board) the majority of methidathion is used on citrus as a foliar spray (likely maximum 180,000 lbs ai); followed by all other orchard crops as a non foliar dormant spray from mid November through February (likely maximum 306,000 lbs ai) and lastly cotton as an early season foliar spray (likely maximum 45,000 lbs ai). As was noted elsewhere in this document, methidathion is either registered for a single application or is typically applied only once (perhaps twice) per season even for citrus, walnuts and cotton.

B. Characterization of the Fate and Transport of Methidathion

Methidathion is moderately mobile, with Kads ranging from ~2 to 15 and Kdes ranging from 3 to 16. In the environment, methidathion is unlikely to persist extensively, i.e., from one year to the next. However, the expected dissipation rate of methidathion on wildlife food items is such that birds and mammals may be exposed to concentrations exceeding chronic levels of concern for several weeks. With an aerobic soil half-life of 11 days, and an anaerobic half-life of 10 days, methidathion is unlikely to persist in water long enough to be a serious groundwater or drinking water problem. Methidathion may enter surface water both with spray drift, and in solution in runoff water. Based on modeling, concentrations in surface water exceed levels of concern for both acute and chronic effects to fish and invertebrates.

C. Characterization of Ecological Risk

Methidathion represents a serious risk to the ecosystem in areas of use. It exceeds the levels of concern for both acute and chronic effects to mammals,birds, fish, and aquatic invertebrates. For both terresterial and aquatic organisms, chronic risk quotients are larger than acute risk quotients. Based on the magnitude of aquatic risk quotients, freshwater and estuarine invertebrates are at greater acute and chronic risk than fish. In certain areas of use, shrimp fisheries or other commercial aquatic invertebrate operations may be adversely impacted by methidathion. Effects on invertebrate numbers and/or diversity could also affect commercial and recreational fisheries, since aquatic invertebrates are the basis of the food supply for many fish species.

Potential Risk to Estuarine Organisms

Aquatic organisms are most likely to be exposed to methidathion during the winter rainy season as contrasted to the rest of the year. Contamination of surface water will occur not only form drift but also from run off following dormant sprays. Personal communication with Dr. Brain Anderson at the Institute of Marine Science (Univ. Cal at Santa Cruz) indicated that Mysid shrimp have shown to be at greater risk when exposed to Pajaro River water collected during the winter season than at other times of the year. Based on acute and chronic Rqs , estuarine invertebrates appeared to be at greater risk then any other group of non target organisms. However, methidathion's use in California indicates that only artichokes (principally in Monterey county) might result in estuarine contamination. All other uses of methidathion (ie. cotton and orchards) are either in non coastal counties or when in coastal counties the treated acreage is extremely low and usually some distance from estuaries. Artichokes are grown along the Salinas and Pajaro Rivers within a quarter mile of the lagoons comprising Monterey Bay. Although there are oyster beds in this area they are closed to harvesting due to fecal coliform contamination.

There is some commercial fishing for Ling Cod and Stripped bass occurring in Monterey Bay. Estuarine fish are acutely less sensitive than invertebrates to methidathion. The high acute risk LOC is only slightly exceed.

Chronic Risk Discussion

While methidathion is not particularly persistent on terrestrial food items, multiple applications result in long-term exceedances of chronic levels of concern. As the table below indicates, the effects on which the NOAELs are based reflect significant reproductive impacts.

Table : Chronic effects observed in life-cycle tests with methidathion			
Species	**NOAEL**	**LOAEL**	**Observed Effects**
Mallard	1 ppm	10 ppm	Increase in cracked eggs, reduction in hatchling numbers, and decreased survival of young
Laboratory rat	4 ppm	32 ppm	Increased offspring mortality
Fathead minnow	6.1 ppb	12 ppb	Reduction in post-hatch survival and growth
Daphnia magna	0.66 ppb	1.13 ppb	Reduced number of young per female per reproduction day
Shrimp	0.02 ppb	0.06 ppb	Reduced adult survival

Table : Avian and Mammalian Chronic Risk Quotients for Typical Applications of Methidathion.
A Foliar Dissipation Halflife 11.3 Days was Assumed, FATE Model Run was for 30 days

Site	App Rate # Apps App Int.	Food Items	Peak Mean EEC (ppm)	RQ	Time Wgt Avg Mean EEC (ppm)	RQ	duration of LOC exceedance
Avian Chronic NOAEL = 1 ppm LOAEL = 10 ppm							
Almonds Walnuts Stone Fruits	typ rate 1.5 lb/A 1 appl/yr	short grass forage	127 67	127 67	58 31	58 31	30+ days
Cotton	typ rate 0.5 lb/A 2 appl/yr	short grass forage	70 37	70 37	37 19	37 19	30+ days
Mammal Chronic NOAEL = 5 ppm LOAEC = 25 ppm							
Almonds Walnuts Stone Fruits	typ rate 1.5 lb/A 1 appl/yr	short grass forage	127 67	25 13	58 31	11 6	30+ days
Cotton	typ rate 0.5 lb/A 2 appl/yr	short grass forage	70 37	14 7	37 19	7 3	30+ days

This table shows that even at typical application rates, and with one or two applications per year, chronic LOCs are exceeded by a substantial margin, and for several weeks. Note that in most cases peak mean and time weighted average mean estimated exposure levels exceed the test levels at which effects were observed (LOAECs). One of the effects of methidathion in the laboratory was increased cracked eggs at the LOAEL. Cracked eggs are a significant ecological impact.

Food Chain Effects

Many birds depend on aquatic invertebrates and fish as food. With adverse effects to these organisms, there is the potential that species depending on them for food would be affected if populations of prey species were depleted.

Effects to Shrimp

Methidathion is particularly toxic to shrimp. The risk quotients suggest a significant potential for adverse effects are high. If methidathion is used in close proximity to estuarine habitat, e.g. in Florida, adverse effects to shrimp and shrimp fisheries are possible.

Uncertainties

There is some uncertainty in using EECs derived for freshwater habitats to assess risk to estuarine and marine organisms. Exposure levels in estuarine environments may be higher or lower than exposure in freshwater environments, depending on dilution caused by the tidal ebb and flow. In some estuaries, the dilution would be substantial, reducing concentrations in a short period of time. However, in other backwater brackish habitat, where the water rises and falls with the tide but does not exchange rapidly, the concentration levels might more closely resemble those in an enclosed pond scenario. Therefore, the EFED cannot conclude that exposure in estuaries is either higher or lower than the modeled values. Therefore, the relatively large magnitude of the risk quotients for shrimp suggest a high potential for risk.

Other uncertainties stem from the use of the Kenega nomograph (as modified by Fletcher) to estimate residues on insects. Neither Kenega (1972) nor Fletcher (1994) collected information on insects. The predictions of residues on insects is based solely on a comparison of the volume to surface area ratio for insects with vegetation of similar ratios. For examples, small fruits and berries may be similar in volume to surface area ratios to large insects. Therefore, insects treated by methidathion are assumed to have residues similar to those other food items.

The uncertainty of residues on insects is even more uncertain when trying to estimate long-term exposure from multiple applications. The assessment assumed the same insects remained equally exposed to each application and thus residues from these subsequent treatments were additive.

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APPENDIX I: Tier I Water Resources Assessment

A tier 1 drinking water assessment for methidathion was reported previously on December 17, 1997. Due to a recent submission of the 30-day laboratory soil aerobic metabolism for methidathion, the drinking water assessment was re-done to reflect the new result. In this revision, we also corrected the adsorption value with organic carbon (Koc) based on the previous value of Kom (adsorption value with organic matter). .

Environmental Fate:

The environmental fate data for methidathion used in the screening assessment are summarized in Table 1 with the new inputs identified by an "*."

Methidathion Use:

The major methidathion use information is listed in Table 2, which is based on the handout from 9/29/97 SMART meeting and the proposed labels submitted by Novartis on 11/03/97. Both the maximum application rates and the typical application rates are presented.

Drinking Water Assessment:

Using the fate properties listed in Table 1 and the use information presented in Table 2, SCI-GROW was used to estimate the drinking water concentrations from ground water and GENEEC was used to estimate the drinking water concentrations from surface water. Concentrations were estimated for both the maximum and typical application rates for each of nine crops upon which methidathion is used.

SCI-GROW Results:

Based on (1) an aerobic soil metabolism half-life input of 11.28 days, (2) a median soil organic carbon partition coefficient of 318 L/kg, and (3) total application rate per year, the SCI-GROW results are listed in Table 3. For the maximum application rates, the estimated concentrations range from 0.0458 ug/L to 0.4884 ug/L. Among the use pattern examined, the cotton use pattern has the highest concentration. For the typical application rates, the range is from 0.0153 ug/L to 0.0611 ug/L. Citrus use pattern has the highest concentration.

GENEEC Results:

Based on (1) an aerobic soil metabolism half-life input of 11.28 days, (2) a median soil organic carbon partition coefficient of 318 L/kg, (3) a water solubility of 250 mg/L, (4) no aerobic aquatic metabolism half-life, (5) a water photolysis half-life at pH 7 of 11 days, (6) a hydrolysis half-life at pH 7 of 48 days, and (7) the application information (including rate, number of applications, and interval between applications), the GENEEC results are presented in Table 4. Based on the maximum application rates, safflower usage has the minimum peak concentration of 9.42 ug/L and walnuts usage has the maximum of 222.30 ug/L. The minimum and maximum 56-day concentrations are 17.87 and 134.96 ug/L for safflower and walnuts, respectively. For the typical application rates, the minimum and maximum peak concentrations are 12.28 and 7.45 ug/l, respectively for safflower and citrus. The minimum and maximum 56-day concentrations are 7.45 and 29.79 ug/L for safflower and citrus, respectively.

TABLE 1. Summary of Selected Environmental Fate Properties for Methidathion.

Property	Range (median)	Value used in assessment	Model
Solubility	250 mg/L	250 mg/L	GENEEC
Hydrolysis $T_{1/2}$	37 days @pH 5 48 days @ pH 7 13 days @ pH 9	48 days	GENEEC
Aquatic Photolysis $T_{1/2}$	11 days @ pH 7	11 days	GENEEC
Aerobic Soil Metabolism $T_{1/2}$	3 days and 11.28 days	*11.28 days	GENEEC SCI-GROW
Anaerobic Soil Metabolism $T_{1/2}$	10 days	not considered	
Aerobic Aquatic Metabolism $T_{1/2}$	no data	not considered	
KOC	Kom: 113 - 338 (191)	*use 191/0.6 = 318	GENEEC/SCI-GROW

Note: "*" denotes the new inputs for SCI-GROW and GENEEC

Table 2. Methidathion Use Information Based on Supracide® 25 WP Label.

Maximum Application Rates for Supracide® 25WP:

Crop	Rate Per Application	# of Applications	Total Applied	Total AI
Almonds	12	1	12	3
Artichokes	4	8	32	8
Citrus	20	2	40	10
Cotton	4	16	64	16
Olives	12	1	12	3
Pome Fruits	12	1	12	3
Stone Fruits	12	1	12	3
Safflower	2	3	6	1.5
Walnuts	12	3	36	9

Typical Application Rates for Supracide® 25WP:

Crop	Rate Per Application	# of Applications	Total Applied	Total AI
Almonds	6	1	6	1.5
Artichokes	4	2	8	2
Citrus	8	1	8	2
Cotton	2	2	4	1
Olives	6	1	6	1.5
Pome Fruits	6	1	6	1.5
Stone Fruits	6	1	6	1.5
Safflower	2	1	2	0.5
Walnuts	6	1	6	1.5

Table 3. Tier 1 (SCI-GROW) Estimates of Ground Water Concentrations for Methidathion.

Maximum Application Rates for Supracide® 25WP:

Crop	Total AI Applied (lb)	SCI-GROW Conc. (ppb)
Almonds	3	0.0916
Artichokes	8	0.2442
Citrus	10	0.3052
Cotton	16	0.4884
Olives	3	0.0916
Pome Fruits	3	0.0916
Stone Fruits	3	0.0916
Safflower	1.5	0.0458
Walnuts	9	0.2747

Typical Application Rates for Supracide® 25WP:

Crop	Total AI Applied (lb)	SCI-GROW Conc. (ppb)
Almonds	1.5	0.0458
Artichokes	2	0.0611
Citrus	2	0.0611
Cotton	1	0.0305
Olives	1.5	0.0458
Pome Fruits	1.5	0.0458
Stone Fruits	1.5	0.0458
Safflower	0.5	0.0153
Walnuts	1.5	0.0458

Table 4. Tier 1 (GENEEC) Estimates of Surface Water Concentrations for Methidathion.

Maximum Application Rates for Supracide® 25WP:

Crop	Application Information	Peak GEEC (ppb)	Average 56 day GEEC
Almonds	1 @ 3 lb ai/ac	73.67	44.69
Artichokes	8 @ 1 lb ai/ac	60.14	36.61
Citrus	2 @ 5 lb ai/ac	152.49	92.65
Cotton	16 @ 1 lb ai/ac	119.63	72.86
Olives	1 @ 3 lb ai/ac	73.67	44.69
Pome Fruits	1 @ 3 lb ai/ac	73.67	44.69
Stone Fruits	1 @ 3 lb ai/ac	73.67	44.69
Safflower	3 @ 0.5 lb ai/ac	29.42	17.87
Walnuts	3 @ 3 lb ai/ac	222.30	134.96

Typical Application Rates for Supracide® 25WP:

Crop	Application Information	Peak GEEC (ppb)	Average 56 day GEEC
Almonds	1 @ 1.5 lb ai/ac	36.83	22.34
Artichokes	2 @ 1 lb ai/ac	40.25	24.45
Citrus	1 @ 2 lb ai/ac	49.11	29.79
Cotton	2 @ 0.5 lb ai/ac	24.16	14.67
Olives	1 @ 1.5 lb ai/ac	36.83	22.34
Pome Fruits	1 @ 1.5 lb ai/ac	36.83	22.34
Stone Fruits	1 @ 1.5 lb ai/ac	36.83	22.34
Safflower	1 @ 0.5 lb ai/ac	12.28	7.45
Walnuts	1 @ 1.5 lb ai/ac	36.83	22.34

APPENDIX II: Environmental Fate and Chemistry Study Identification

161-1: Hydrolysis
Saxena, A.M. 1989b. Hydrolysis of ^{14}C-methidathion in buffered aqueous solutions. Laboratory Project ID: HLA 6117-134. Unpublished study performed by Hazleton Laboratories, Inc., Madison, WI, and submitted by Ciba-Geigy Corporation, Greensboro, NC. (42037701)

161-2: Photolysis in Water
Saxena, A.M. 1989a. Artificial sunlight photodegradation of ^{14}C-methidathion in a buffered aqueous solution. Laboratory Project ID: HLA 6117-137. Unpublished study performed by Hazleton Laboratories, Inc., Madison, WI, and submitted by Ciba-Geigy Corporation, Greensboro, NC. (42081709)

161-3: Photolysis on soil
Das, Y.T. 1990. Photodegradation of [^{14}C]methidathion on soil under artificial sunlight. Laboratory Project ID: ISSI No. 90081; Ciba-Geigy Protocol No. 137-90. Unpublished study performed by Innovative Scientific Services, Inc., Piscataway, NJ, and submitted by Ciba-Geigy Corporation, Greensboro, NC. (42081710)

161-4: Photolysis in air
Kieatiwong, S. 1992. Photodegradation of [^{14}C]methidathion in the vapor phase by natural sunlight. PTRL Project No. 331W. Ciba-Geigy Protocol No. 84-91. Unpublished study performed by PTRL-West, Inc., Richmond, CA, and submitted by Ciba-Geigy Corporation, Greensboro, NC. (42215101)

Getzin, L.W. 1970. Persistence of methidathion in soils. Bulletin of Environmental Contamination and Toxicology 5(2): 104-110. (05011889)

Obrist, J.J. 1991. Aerobic, aerobic/anaerobic, and sterile soil metabolism of ^{14}C-methidathion. Laboratory Project ID: HLA 6117-135, Ciba-Geigy Protocol No. 197-90. Unpublished study performed by Hazleton Laboratories America, Inc., Madison, WI, and submitted by Ciba-Geigy Corporation, Greensboro, NC. (42262501)

162-1: Aerobic soil metabolism
Obrist, J.J. 1991. Aerobic, aerobic/anaerobic, and sterile soil metabolism of ^{14}C-methidathion. Laboratory Project ID: HLA 6117-135, Ciba-Geigy Protocol No. 197-90. Unpublished study performed by Hazleton Laboratories America, Inc., Madison, WI, and submitted by Ciba-Geigy Corporation, Greensboro, NC. (42262501)

163-1: Mobility/ Adsorption/ Desorption
Burkhard, N. 1980. Adsorption and desorption of methidathion (Supracide, Ultracide) in various soil types. Project Report 08/80. Unpublished study prepared by Biochemistry Department, R & D Plant Protection, Agricultural Division, Ciba-Geigy Ltd., Basle, Switzerland and submitted by Ciba-Geigy Corporation, Greensboro, NC. (01585-29)

163-1: Mobility/column leaching
Blair, J. 1985. Leaching characteristics of parent methidathion. Study No. 6015-154. Prepared by Hazleton Laboratories America, Inc. Madison, WI, and submitted by Ciba-Geigy Corp., Greensboro, NC. (00158528)

163-1-:Mobility/Column Leaching
Shepler, K. 1992. Aged leaching of [^{14}C]methidathion in four soil types. PTRL Project No. 332W. Ciba-Geigy Protocol No. 81-91. Unpublished study performed by PTRL-West, Inc., Richmond, CA, and submitted by Ciba-Geigy Corporation, Greensboro, NC. (42215102)

163-2: Laboratory volatility
Kesterson, A. 1991. Laboratory volatility of [^{14}C]methidathion. PTRL Project No. 556. Ciba-Geigy Study No. 48-91. Unpublished study performed by PTRL East, Inc., Richmond, KY, and submitted by Ciba-Geigy, Greensboro, NC. (42098801)

164-1: Terrestrial field dissipation
Abu Zayda, I.S. 1976. Dynamics of Ultracide (GS 13005) degradation in plants and soils and its effectiveness against Colorado potato beetle ((Leotinotarsa decemlineata Say). Prace Naukowe Instytutu Ochrony Poslin. Scientific Papers of the Institute of Plant Protection. XVIII(1):81-145. (05015398)

Bade, T.R. 1987a. Field dissipation of methidathion and GS-13007 residues in bare ground soil following application of supracide 2E (field soil dissipation). Study No. ABR-86125. Prepared and submitted by Ciba-Geigy Corp., Greensboro, NC. (40094103)

Richardson, C. 1971. Residue Report: AG-A No. 2127; Project No. 303001. Unpublished study including addendum, received May 12, 1972 under 100- 510; submitted by Ciba-Geigy Corp., Greensboro, NC.(00011827)

Wiepke, T., and M. Larson. 1991. Supracide 2E field dissipation terrestrial study on citrus in California. Laboratory Project ID: Landis Protocol No. 1641-88-71-13-01A-03; Ricerca Document No. 3031-88-0048-CR-0001. Unpublished study performed by Landis International, Inc., Valdosta, GA, Research for Hire,

Porterville, CA, and Ricerca, Inc., Painesville, OH; and submitted by Ciba-Geigy Corporation, Greensboro, NC.(41924401)

Lepke, T., and M. Larson.1991. Supracide 2E field dissipation - terrestrial study on bareground in California. Laboratory Project ID: Landis Protocol No. 1641-88-71-13-21E-04; Ricerca Document No. 3030-88-0047-CR-001. Unpublished study performed by Landis International, Inc., Valdosta, GA, Research for Hire, Porterville, CA, and Ricerca Inc., Painesville, OH; and submitted by Ciba-Geigy Corporation, Greensboro, NC.(41924402)

Wiepke, T., and M. Larson. 1991. Supracide 2E field dissipation - terrestrial study on alfalfa in Virginia. Laboratory Project ID: Landis Protocol No. 1641-88-71-13-05B-01; Ricerca Document No. 3029-0046-CR-0001. Unpublished study performed by Landis International, Inc., Valdosta, GA, J & S Plant Consultants, Inc., Skippers, VA, and Ricerca, Inc., Painesville, OH; and submitted by Ciba-Geigy Corporation, Greensboro, NC. (41924403)

165-4: Accumulation in fish
Forbis, A.D., L Georgie, and B. Bunch. 1985. Uptake, depuration, and bioconcentraion of ^{14}C-Supracide by bluegill sunfish (Lepomis macrochirus). ABC Report No. 33121. Unpublished study prepared by Analytical Bio-Chemistry Laboratories, Inc. and submitted by Ciba-Geigy Corp., Greensboro, NC. (00158532)

APPENDIX III:

ENVIRONMENTAL FATE
DATA REQUIREMENTS FOR
Methidathion

Chemical No: 100301

Data Requirement	Use Pattern[2]	Does EPA have data to satisfy this requirement	Bibliographic citation	Must additional data be submitted
§158.290 ENVIRONMENTAL FATE				
Degradation Studies-Lab:				
161-1 Hydrolysis	1,3	Partially	42037701	Yes
161-2 Photodegradation In Water	1,3	No	42081709	Yes
161-3 Photodegradation On Soil	1	No	42081710	Yes
161-4 Photodegradation In Air	1	Partially	42215101	No
Metabolism Studies-Lab:				
162-1 Aerobic Soil	1,3	Partially	44545101	Yes
162-2 Anaerobic Soil	1	No	(42262501)	Yes
162-3 Anaerobic Aquatic	1,3	No		No
162-4 Aerobic Aquatic	1,3	No		No
Mobility Studies:				
163-1 Adsorption/Desorp	1,3	Partially	00157529	Yes
163-1 Column leaching	1,3	No	(42215102)[2]	Yes
163-2 Volatility (Lab)	1,	Yes	42098801	No
Dissipation Studies-Field:				
164-1 Soil	1,3	No	(05015398)[2], 41924401, 41922402	Yes
Accumulation Studies:				
165-4 In Fish	1,3	No	(00158532)[2]	No (waived)
Ground Water Monitoring Studies:				
166-1 Small-Scale Prospective		No		Reserved[3]
§158.440 Spray Drift:				
201-1 Droplet Size Spectrum		No		Reserved[4]
202-1 Drift Field Evaluation		No		Reserved[4]

FOOTNOTES:

1. 1=Terrestrial Food; 2=Terrestrial Feed; 3=Terrestrial Non-Food; 4=Aquatic Food; 5=Aquatic Non-Food (Outdoor); 6=Aquatic Non- Food (Industrial); 7=Aquatic Non-Food (Residential); 8=Greenhouse Food; 9=Greenhouse Non-Food; 10=Forestry; 11=Residential Outdoor; 12=Indoor Food; 13=Indoor Non-Food; 14=Indoor Medical; 15=Indoor Residential.
2. Submitted study is invalid; must be repeated
3. Prospective study required pending results of field dissipation study.
4. The Spray Drift Task Force and the registrant will address 201-1 and 202-2

APPENDIX IV:

ECOLOGICAL EFFECTS
DATA REQUIREMENTS FOR

Chemical No: 100301

Methidathion

Data Requirement	Use Pattern[3]	Does EPA have data to satisfy this requirement	Bibliographic citation	Must additional data be submitted
§158.490 Wildlife and Aquatic Organisms				
Avian and Mammalian Testing:				
71-1 Avian Acute Oral LD_{50}	1,,3	Yes	00157347	No
71-2 Avian Dietary LC_{50}	1,,3	Yes	00159201, 42081701 No	
71-3 Wild Mammal Toxicity Test	1,3	No		No
71-4 Avian Reproduction Test	1,3	Partially	44381602, (44381601[2])	Yes
71-5 Simulated Terrestrial Field Test	1,3	No		No
Aquatic Organism Testing:				
72-1 Freshwater Fish LC_{50}				
a. warmwater TGAI	1,3	Yes	40098001, 0011841	No
b. coldwater TGA	1,3	Yes	40098001, 0011841	No
c. warmwater TEP	1,3	Yes	42081702	No
d. coldwater TEP	1,3	Yes	42081703	No
72-2 Freshwater Invertebrate LC_{50}				
a. TGAI	1,3	Yes	0011350	No
b. TEP	1,3	Yes	42081704	No
72-3 Marine/Estuarine LC_{50}				
a. fish TGAI	1,3	Yes	00157350	No
b. mollusc TGAI	1,3	Yes	42185201	No
c. shrimp TGAI	1,3	Partially	40228401	No
d. fish TEP	1,3	Yes	43738501	No
e. mollusc TEP	1,3	Yes	42185202	No
f. shrimp TEP	1,3	No		No
72-4 a. Fish early life-stage TGAI	1,3	Partially	0015736	Yes
b. Invertebrate life-cycle TGAI	1,3	Yes	42081707	No
72-5 Fish Life-Cycle TGAI	1,3	No		Yes
72-6 Aquatic Organism Accumulateion		Partially		No (See Fate Table)
72-7 Simulated Aquatic Field Test		No		No
§158.150 Nontarget Plant Protection:				
Non-Target-Area Phytotoxicity				
Tier I - TGAI				
122-1 a. Seed Germination/Seedling Emergence		No		No
b. Vegetative Vigot		No		No
122-2 Aquatic Plant Growth		No		No
Tier II - TGAI				
123-1 a. Seed Germination/Seedling Emergence		No		No
b. Vegetative Vigor		No		No
123-2 Aquatic Plant Growth		No		No
§158.590 Nontarget Insect Testing-Pollinators				
141-1 Honeybee Acute Contact TGAI	1,3	Yes	0036935	No
141-2 Honeybee Toxicity of Residues TEP	1,3	Yes	420817-08	No
141-5 Field Testing for Pollinator		No		No

1=Terrestrial Food; 2=Terrestrial Feed; 3=Terrestrial Non-Food; 4=Aquatic Food; 5=Aquatic Non-Food (Outdoor); 6=Aquatic Non- Food (Industrial); 7=Aquatic Non-Food (Residential); 8=Greenhouse Food; 9=Greenhouse Non-Food; 10=Forestry; 11=Residential Outdoor; 12=Indoor Food; 13=Indoor Non-Food; 14=Indoor Medical; 15=Indoor Residential.
2. Submitted study is invalid; must be repeated

1. 1=Terrestrial Food; 2=Terrestrial Feed; 3=Terrestrial Non-Food; 4=Aquatic Food; 5=Aquatic Non-Food (Outdoor); 6=Aquatic Non- Food (Industrial); 7=Aquatic Non-Food (Residential); 8=Greenhouse Food; 9=Greenhouse Non-Food; 10=Forestry; 11=Residential Outdoor; 12=Indoor Food; 13=Indoor Non-Food; 14=Indoor Medical; 15=Indoor Residential.

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